



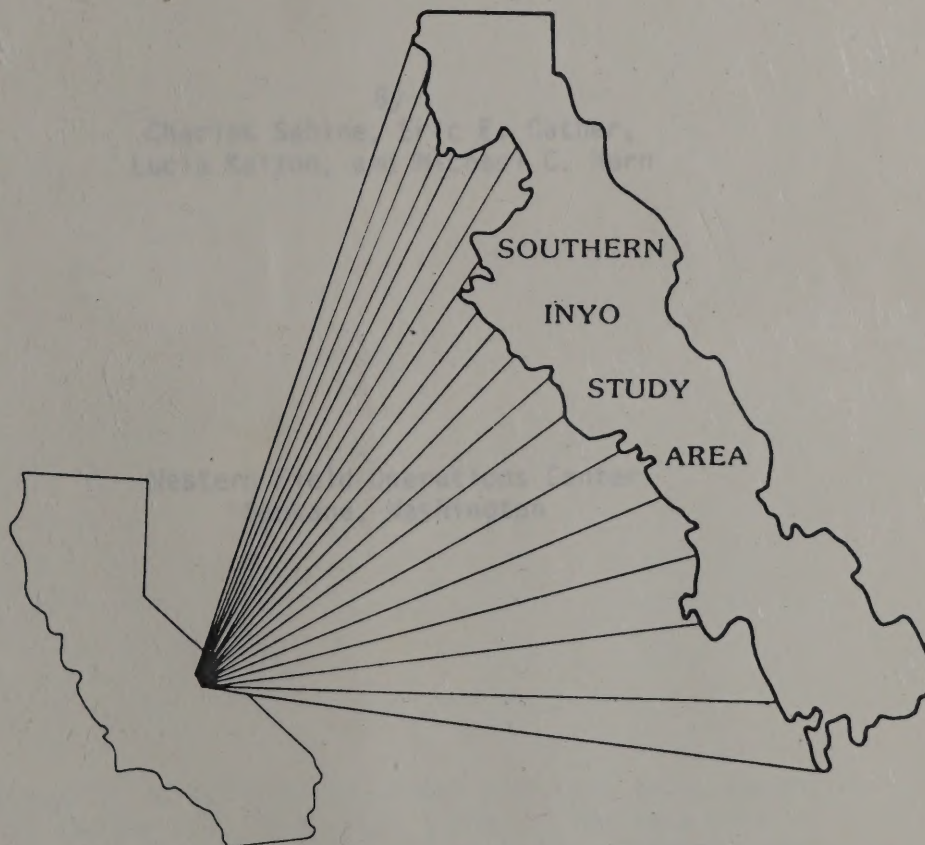
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Open File Report

Mineral Resources of the Southern Inyo Study Area, Inyo County, California



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MINERAL RESOURCES OF THE SOUTHERN INYO STUDY
AREA, INYO COUNTY, CALIFORNIA

By

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Spokane, Washington

This open-file report will be summarized in a joint report published by the U.S. Geological Survey. The data were gathered and interpreted by Bureau of Mines personnel from Western Field Operations Center, East 360 Third Avenue, Spokane, WA 99202. The report has been edited by members of the Branch of Mineral Land Assessment at the field center and reviewed at the Bureau of Mines, Washington, D.C.

UNITED STATES DEPARTMENT OF THE INTERIOR
Donald P. Hodel, Secretary

BUREAU OF MINES
Robert C. Horton, Director

PREFACE

The Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976) requires the U.S. Geological Survey and U.S. Bureau of Mines to conduct mineral surveys on U.S. Bureau of Land Management administered land designated as Wilderness Study Areas ". . . to determine the mineral values, if any, that may be present" Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a Bureau of Mines mineral survey of a portion of the Southern Inyo Wilderness Study Area (CA-010-056), Inyo County, CA.

This open-file report will be summarized in a joint report published by the U.S. Geological Survey. The data were gathered and interpreted by Bureau of Mines personnel from Western Field Operations Center, East 360 Third Avenue, Spokane, WA 99202. The report has been edited by members of the Branch of Mineral Land Assessment at the field center and reviewed at the Division of Mineral Land Assessment, Washington, DC.

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INTRODUCTION

The western slope of the Southern Inyo Mountains was designated a wild (Wilderness Study Area) by the BLM, U.S. Bureau of Land Management, in 1979. Because wilderness status entails withdrawal from mining entry, the USBL (U.S. Bureau of Land) and the USGS (U.S. Geological Survey) jointly evaluated mineral resources and resource potential of a 27,420-acre study area within the 35,500-acre Southern Inyo MSA as part of the wilderness review process. The USBL examines individual mines, prospects, claims, and mineralized zones and evaluates identified mineral and energy resources. The USGS evaluates potential for undiscovered resources based on broad geological, geochemical, and geophysical surveys. Combined results will be summarized in a joint report to be published by USBL. This report presents the results of the USBL's portion of the study. Although the immediate goal of this and

SUMMARY

In 1984 and 1985 at the request of the U.S. Bureau of Land Management, the U.S. Bureau of Mines studied a 27,420-acre part of the 36,600-acre Southern Inyo Wilderness Study Area, CA-010-056, in order to evaluate the mineral resources. The study area is located in Inyo County, CA, near the town of Lone Pine, about 180 miles north of Los Angeles. The study area takes in most of the western slope of the southern Inyo Mountains. Terrain is steep and rugged; the climate is arid. The study area is underlain by folded and faulted marine sedimentary rocks dating from Ordovician to Triassic, Triassic volcanic rocks, and Jurassic to Cretaceous plutonic rocks. Most mineralization was along faults and shear zones in sedimentary rocks.

The study area includes most of the Russ and Lone Pine mining districts which produced over one million dollars in gold, silver, lead, and zinc, mostly between 1860 and 1890. A few mines produced ore as late as 1951. Most production was from the Reward, Silver Spur, Long John, and Pennsylvania mines which are outside the study area. Presently, there is no mining activity in the study area; some development work was done at the Reward mine between 1981 and 1984. Dolomite marble is quarried from the base of the range outside the study area. There are currently about 70 mining claims in the study area.

Sixty-six mines and prospects in and adjacent to the study area were mapped and sampled. Most are small occurrences of silver, lead, zinc, gold, and copper in thin veins. Small lenses of talc occur at five sites and barite at one. No resources are identified at any of the sites although resources may exist at the Reward and Silver Spur mines. The possibility of an economic ore deposit cannot be ruled out, however. Exploration is warranted at six localities or trends which were identified in this study. Modern exploration methods, such as geologic mapping, sampling, geochemical and geophysical surveys, and drilling, would show if resources are present in these areas.

INTRODUCTION

The western slope of the Southern Inyo Mountains was designated a WSA (Wilderness Study Area) by the BLM (U.S. Bureau of Land Management) in 1979. Because wilderness status entails withdrawal from mining entry, the USBM (U.S. Bureau of Mines) and the USGS (U.S. Geological Survey) jointly evaluated mineral resources and resource potential of a 27,420-acre study area within the 36,600-acre Southern Inyo WSA as part of the wilderness review process. The USBM examines individual mines, prospects, claims, and mineralized zones and evaluates identified mineral and energy resources. The USGS evaluates potential for undiscovered resources based on areal geological, geochemical, and geophysical surveys. Combined results will be summarized in a joint report to be published by USGS. This report presents the results of the USBM's portion of the study. Although the immediate goal of this and

other USBM mineral surveys is to provide data for the President, Congress, government agencies, and the public for land-use decisions, the long-term objective is to ensure the Nation has an adequate and dependable supply of minerals at a reasonable cost.

Setting

The study area is located in eastern California about 180 mi (miles) north of Los Angeles (fig. 1). It takes in the western slope of the southern Inyo Mountains east of the community of Lone Pine. Elevations range from 3,680 ft (feet) at the foot of the range to 11,107 ft on Mount Inyo. Terrain is steep and mountainous in the northern part of the study area; average topographic gradients are approximately 2,200 ft/mi. Topography is more subdued in the southern end of the area with gradients approximately 600 ft/mi (fig. 2). Dry desert conditions prevail. Underground mine workings are well preserved, vegetation is sparse, and rocks are well exposed. A few perennial springs provide some water in the northern part of the area; water is scarce in the southern part.

Access to the area is limited. Several unimproved roads end at the base of the range or extend a short way up some of the washes. A very poor four-wheel-drive road from Swansea to New York Butte forms the southern boundary of the WSA. Another four-wheel-drive road along the crest of the range from Cerro Gordo to New York Butte was washed out and impassable. Numerous foot trails date from the time mines were active in the study area and in the Beveridge district on the east side of the range (fig. 2).

Previous Studies

Prior to this study, there was no systematic and comprehensive inventory of mineral occurrences in the area. Some data were available from countywide surveys by Norman and Stewart (1951) and Tucker and Sampson (1938), and statewide commodity surveys such as those by Clark (1970), Goodwin (1957), and Eric (1948). Page (1951) did a comprehensive survey of talc deposits in Inyo County which included deposits adjoining the south end of the study area. A reconnaissance of mines and prospects had been done under a BLM contract by Great Basin GEM (geology, energy, and mineral) Joint Venture (1983).

The only detailed, published geologic mapping in the study area was in the portion at the north end that lies in the Independence Quadrangle (Ross, 1965). Ross (1967) also published a map of the Inyo Mountains that is too highly generalized to be useful. Merriam (1963) included a reconnaissance geologic map of the southern portion of the study area in his work on the Cerro Gordo mining district. The USGS completed geologic mapping of the study area in the course of this project (Conrad, 1986).

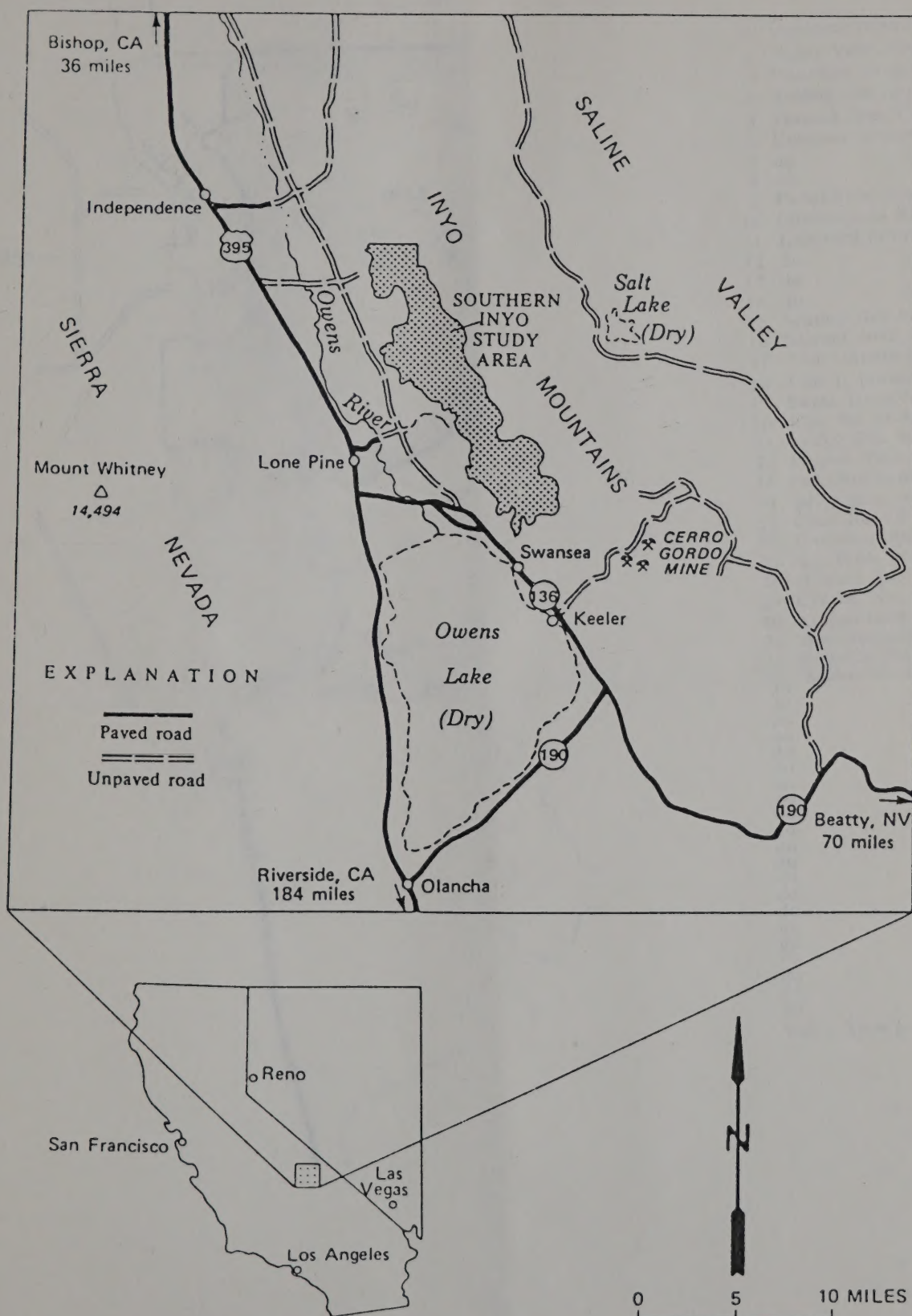


FIGURE 1.— Location map, Southern Inyo study area, Inyo County, CA



FIGURE 2.—Mines and prospects in and adjacent to the Southern Inyo study area, Inyo County, CA

NUMERICAL LIST

- 1 Unnamed prospect
- 2 Valley View prospect
- 3 Unnamed prospect
- 4 Rolling Thunder No. 3 prospect
- 5 Peacock Nos. 1 and 2 prospect
- 6 Unnamed prospect
- 7 do
- 8 do
- 9 Frostbitten prospect
- 10 International Recovery prospect
- 11 Unnamed prospect
- 12 do
- 13 do
- 14 do
- 15 Spanish Belt prospect
- 16 Reward mine
- 17 Annex-Arrow group
- 18 Julie L. prospect
- 19 Sweet Thing No. 2 prospect
- 20 Inyo Bee prospect
- 21 Lucky Slim mine
- 22 Pinyon (Poorchild-Raven) mine
- 23 Old Grindstone mine
- 24 Silver Spur mine
- 25 Cheri No. 20 mine
- 26 Unnamed prospect
- 27 San Pablo prospect
- 28 Howard No. 7 prospect
- 29 Cynthia No. 1-22 prospects
- 30 Golden Lady prospect
- 31 Hummingbird prospect
- 32 Hancock No. 1 prospect
- 33 Patent Pending prospect
- 34 Duarte prospect
- 35 Unnamed prospect
- 36 do
- 37 do
- 38 do
- 39 do
- 40 Macaroon prospect
- 41 Million Dollar Baby prospect
- 42 Burgess mine
- 43 Unnamed prospect
- 44 Far Ridge prospect
- 45 Black Warrior mine
- 46 Delthe Black Warrior mine
- 47 Long John mine
- 48 Unnamed prospect
- 49 do
- 50 do
- 51 do
- 52 do
- 53 do
- 54 do
- 55 Long Trail mine
- 56 Unnamed prospect
- 57 do
- 58 Copper Summit prospect
- 59 Unnamed prospect
- 60 Silver Reef prospect
- 61 Pennsylvania mine
- 62 Unnamed prospect
- 63 do
- 64 Flagstaff mine
- 65 Unnamed prospect
- 66 Bud's Hope mine

ALPHABETICAL LIST

- | | |
|---------------------------------|----|
| Annex-Arrow group | 17 |
| Black Warrior mine | 45 |
| Bud's Hope mine | 66 |
| Burgess mine | 42 |
| Cheri No. 20 mine | 25 |
| Copper Summit prospect | 58 |
| Cynthia No. 1-22 prospects | 29 |
| Delthe Black Warrior mine | 46 |
| Duarte prospect | 34 |
| Far Ridge prospect | 44 |
| Flagstaff mine | 64 |
| Frostbitten prospect | 9 |
| Golden Lady prospect | 30 |
| Hancock No. 1 prospect | 32 |
| Howard No. 7 prospect | 28 |
| Hummingbird prospect | 31 |
| International Recovery prospect | 10 |
| Inyo Bee prospect | 20 |
| Julie L. prospect | 18 |
| Long John mine | 47 |
| Long Trail mine | 55 |
| Lucky Slim mine | 21 |
| Macaroon prospect | 40 |
| Million Dollar Baby prospect | 41 |
| Old Grindstone mine | 23 |
| Patent Pending prospect | 33 |
| Peacock Nos. 1 and 2 prospect | 5 |
| Pennsylvania mine | 61 |
| Pinyon (Poorchild-Raven) mine | 22 |
| Reward mine | 16 |
| Rolling Thunder No. 3 prospect | 4 |
| San Pablo prospect | 27 |
| Silver Reef prospect | 60 |
| Silver Spur mine | 24 |
| Spanish Belt prospect | 15 |
| Sweet Thing No. 2 prospect | 19 |
| Unnamed prospect | 1 |
| do | 3 |
| do | 6 |
| do | 7 |
| do | 8 |
| do | 11 |
| do | 12 |
| do | 13 |
| do | 14 |
| do | 35 |
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| do | 52 |
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| do | 57 |
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| do | 62 |
| do | 63 |
| Valley View prospect | 65 |

Wilderness studies by the USBM and the USGS had been done on two adjoining study areas: the Inyo Mountains Wilderness Study Area to the east (Close, 1985; McKee and others, 1985), and the Mazourka, Paiute, and Andrews Mountain roadless areas to the north (Schmauch and others, 1983; McKee and others, 1983).

Present Study

All available published and unpublished reports on mineral deposits in the area were researched prior to field work. BLM claim records, files, and title plats were examined for current claims and leases, and Inyo County records were searched for historic claims. All current claim owners were contacted as were individuals with knowledge of the geology and mineral deposits of the area.

Sixty-six properties, in and adjacent to the study area, were mapped and sampled during the fall of 1984 and spring of 1985 (fig. 2). Surface maps of the larger properties were made by plane table and alidade; smaller mines and underground workings were mapped by tape and compass. More than 5,000 ft of underground workings were geologically mapped in order to determine the size and geometry of deposits and to assess the likelihood of extensions or unexposed ore bodies. Five hundred seventy-one samples were taken. Most were chip samples across mineralized structures; grab samples from dumps or float were taken at some localities where structures were poorly exposed.

Samples were crushed, mixed, and split at the Western Field Operations Center at Spokane, Washington, and analyzed at the USBM research center at Reno, NV. All samples were analyzed for gold and silver by fire assay with detection limits of 0.01 and 0.1 oz/ton (troy ounce per ton), respectively, or combined fire assay and ICP (inductively coupled plasma) analysis, with detection limits of 0.007 and 0.3 ppm (parts per million), respectively. Samples were also analyzed for 36 elements 1/ by ICP. Detection limits for copper, lead, and zinc were 2, 30, and 1 ppm, respectively.

Talc samples were analyzed for oxides of aluminum, calcium, iron, magnesium, and silicon by x-ray fluorescence, and minerals were identified by x-ray diffraction.

1/ Aluminum, antimony, arsenic, barium, beryllium, bismuth, cadmium, calcium, chromium, cobalt, copper, gold, iron, lanthanum, lead, lithium, magnesium, manganese, molybdenum, nickel, niobium, palladium, phosphorus, potassium, platinum, silver, sodium, strontium, tellurium, tin, titanium, tungsten, vanadium, yttrium, zinc, and zirconium.

Where warranted, the inferred tonnage and average grade of a deposit was calculated using a weighted average method. For vein deposits, the average chip sample length was taken as the average thickness, and the vein is assumed to extend to a depth equal to half the exposed or inferred length unless geological evidence indicated otherwise. Resources are classified according to the scheme used by the U.S. Bureau of Mines and the U.S. Geological Survey (1980).

This survey of mineral occurrences cannot be considered definitive. Limitations of time and resources precluded follow-up of preliminary findings. Moreover, only the highest grade pockets have workings, which introduces a bias into the data set. In most cases, only two dimensions of an occurrence could be delineated. Subsurface data are lacking. A full evaluation of resources would require more detailed mapping and sampling together with appropriate geochemical and geophysical surveys. Anomalies that suggest the presence of an ore body should be core drilled to delineate the size, shape, and grade of the deposit at depth. Such methods were beyond the scope and means of this project.

ACKNOWLEDGEMENTS

Numerous claim owners granted permission to examine their properties and provided maps and assay data which were very helpful in our evaluations. Special thanks are given to Terry Rimsley, mine superintendent, and Steve Johnson, caretaker, for allowing us access to workings in the Reward mine area. Jack Walker of Tehachapi, CA, allowed us to examine his patented claims at the Long John mine.

David Brink, Harry Campbell, Paul Erickson, Edward McHugh, Terry Neumann, and Richard Rains assisted with field work. Terry Close had done an aerial reconnaissance of the study area previously and had also mapped and sampled the Pennsylvania mine. His knowledge of the area was invaluable and his advice sound.

GEOLOGIC SETTING

The Inyo Mountains occupy a transition zone between the primarily Paleozoic marine assemblage of the Basin and Range geologic province, and the composite batholith that characterizes the Sierra Nevada province (Ross, 1965, p. 2). The study area is underlain by Cambrian to Permian limestone, dolomite, shale, and quartzite; Triassic marine sedimentary rocks and andesitic volcanic rocks; and Jurassic to Cretaceous dioritic to granitic intrusive rocks (fig. 3).

The Paleozoic sequence was deposited near the edge of the North American craton. Cambrian to Ordovician rocks were derived from sediments deposited in intertidal to subtidal environments that locally contained algal mats (Moore, 1979; Arneill-Brown, 1982). Gradual subsidence after the Cambrian resulted in generally deeper depositional

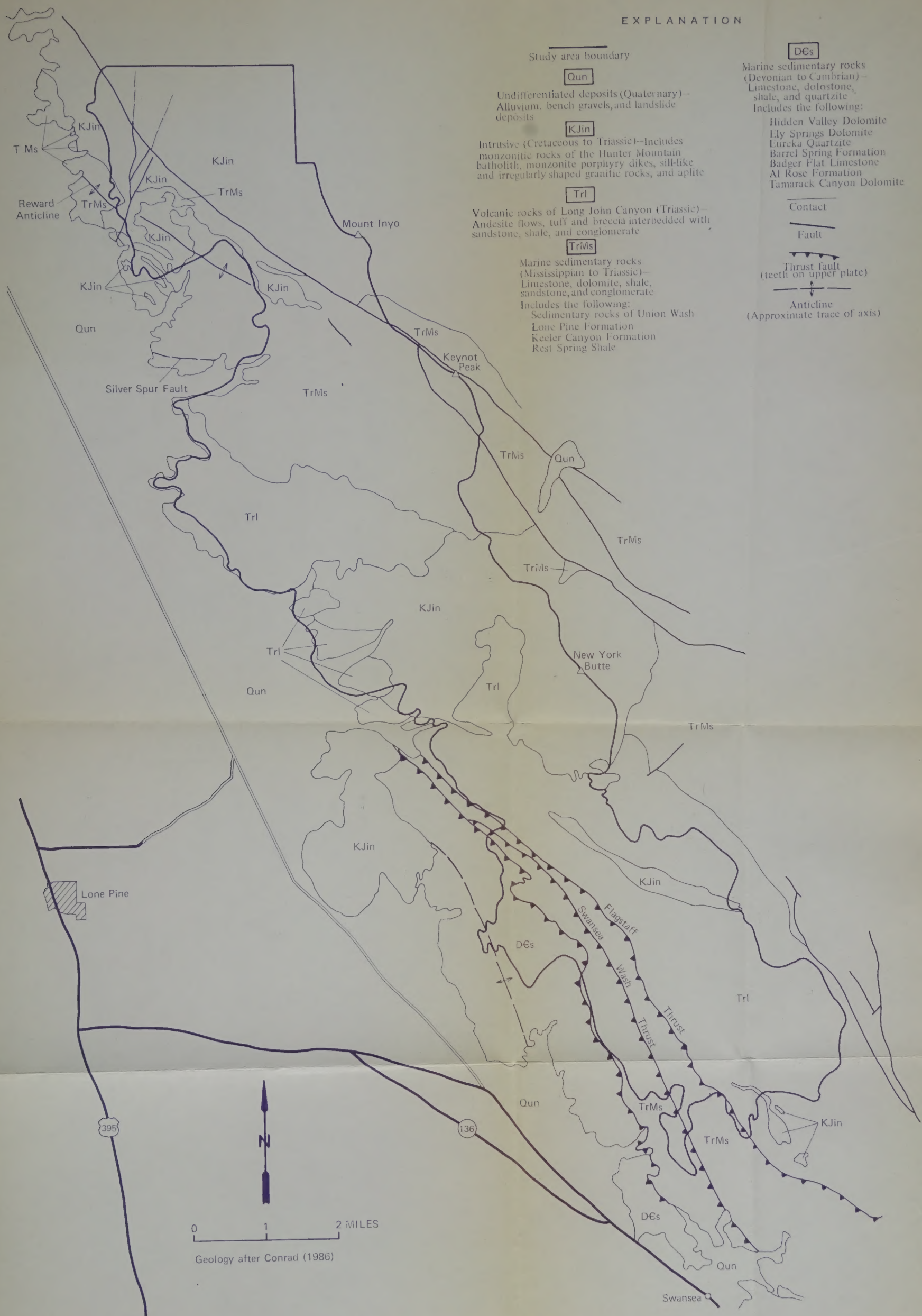


FIGURE 3.— Geologic map of the Southern Inyo study area

environments which changed from continental shelf deposits to Mississippian basinal deposits (Stevens, 1986). Noteworthy in the Ordovician-Silurian section are the Eureka Quartzite, a widespread formation that has been mined for silica, and the Hidden Valley Dolomite, a formation that has yielded dolomite marble along the southwest boundary of the study area. From early Pennsylvanian to early Permian time, deposition changed from relatively deep-water carbonates to a continental slope turbidite assemblage. Late Permian coarse clastics indicate subtidal, intertidal, and fluvial to alluvial environments (Stone and others, 1979). Early to Middle Triassic shale and limestone, which were deposited in a shallow marine environment, grade upward to coarse clastic, volcanoclastic, and finally andesitic volcanic rocks which mark the beginning of an active volcanic-plutonic arc environment (Oborne and Dunne, 1982).

Plutonic rocks of the Jurassic Hunter Mountain batholith intrude the Paleozoic and Triassic rocks in the eastern part of the study area and are exposed in isolated outcrops in the central and western part. The rocks are primarily quartz monzonite, but range to dioritic in composition. Cretaceous granitic rocks are locally abundant as irregularly shaped or sill-like intrusives. Aplite and mafic dikes occur sporadically in the study area (Conrad, 1986).

The Paleozoic to Triassic rocks are on the west limb of the Cerro Gordo anticline, a northwest-trending fold that lies near the crest of the Inyo Range. It extends from 4.5 mi east of New York Butte southeast through the Cerro Gordo mining district (Merriam, 1963). Subsidiary folds include the Reward anticline in the northern portion of the study area, and a faulted anticline near Kern Knob.

Faults and shear zones are common throughout the study area. Many are mineralized. Prominent faults in the north and east are high angle, and generally trend north to northwest. In the southwest portion of the study area, several thrust faults related to the Swansea-Coso thrust system (Burchfiel and Davis, 1981, p. 242) underlie a wedge of pre-Triassic metasediments (Conrad, 1986).

Fractures have been a principal control on mineralization in the study area. They are filled primarily with quartz, but calcite is also a common gangue mineral. Galena is generally the most abundant ore mineral in the veins. It is almost always accompanied by silver, and commonly occurs in about a one-percent-lead to one-oz/ton-silver ratio. Gold was an important constituent of ores from the Reward and Burgess mines. Sphalerite and chalcopyrite are locally abundant. Oxidation of primary ore minerals at most deposits produced a host of secondary ore minerals which include malachite, azurite, native copper, anglesite, cerussite, smithsonite, and hemimorphite. Some occurrences consist entirely of secondary minerals.

Deposits have been discovered in a variety of host rocks. The Hidden Valley Dolomite hosts deposits at the Long John and Black Warrior mines as well as at the Copper Summit and other unnamed prospects. Talc deposits also occur in the dolomite, especially where it is fractured and cherty. Sedimentary and metasedimentary rocks in the Pennsylvanian-Permian section host veins at the Reward, Flagstaff, Pennsylvania, Bud's Hope, Old Grindstone, and Pinyon (Poorchild-Raven) mines, as well as at the San Pablo prospect. The Burgess and Silver Spur mines occur in Triassic marine limestone and shale. Quartz veins at the International Recovery and Spanish Belt prospects are hosted by quartz monzonite and diorite.

MINING HISTORY AND PRODUCTION

Mining activity in the Inyo Mountains began in 1860 when American explorers located the Russ mining district which covers most of the west slope of the range and nearly all of the study area. Since then, millions of dollars worth of precious- and base-metal ore have been produced from mines in and near the study area. Most production was between 1860 and 1890 and is unrecorded. Recorded production is shown in Table 1.

The southern half of the Russ district became the Lone Pine district in 1883. The Union (Silver Spur), Eclipse (Reward), and Ida (Frostbitten or International Recovery) mines were located soon thereafter, and mills were built along the Owens River (Goodyear, 1888, p. 262). About \$200,000 ^{2/} worth of gold was removed from the Eclipse mine by 1883 (Burchard, 1884, p. 160). Thereafter, the mine, known as the Brown Monster and then the Reward mine, produced about \$600,000 of gold, silver, lead, and copper ore between 1889 and 1951. Over \$90,000 worth of silver was recovered from the Union (Silver Spur) mine prior to 1902 (Goodwin, 1957, p. 492).

Rich silver deposits were discovered at Cerro Gordo, which is 5.5 mi southeast of the south end of the study area, around 1865, and the Cerro Gordo mining district was organized in 1866 (Vredenburg and others, 1981, p. 225-226). About \$17 million worth of silver, lead, zinc, and gold was taken from mines at Cerro Gordo between 1865 and 1945 (Vredenburg and others, 1981, p. 225-226), making it one of the largest silver producers in the history of California.

The Swansea district was organized about the same time as the Cerro Gordo district. Much of the ore from Cerro Gordo was smelted at Swansea. About \$120,000 worth of lead, silver, gold, zinc, and copper was produced from the Swansea district between 1879 and 1969 (USBM production files; Dimond, 1890, p. 99; 1891, p. 103, 1892, p. 145).

^{2/} All dollar values are cumulative totals at the time of production.

TABLE 1.--Summary of recorded mineral production from mines in and adjacent to the Southern Inyo study area

Mining district	Map no.	Mine	Principal productive years	Principal commodities	Estimated 1/ value (\$)	Reference
Russ	16	Reward (Brown Monster, Hirsch, Eclipse, F. D. Roosevelt, Golden West)	1879-1880	Gold, silver	5,500	Burchard, 1882, p. 160
			until 1883	Gold, silver	200,000	Burchard, 1884, p. 160
			1889-1951	Gold, silver, lead, copper	600,000	USBM production files
	24	Silver Spur (Union, Monte Carlo, Mt. Whitney)	1889-1891	Gold, silver	18,000	Dimond, 1890, p. 99, Dimond, 1891, p. 103, Dimond, 1892, p. 145
			prior to 1902	Silver	90,000	Goodwin, 1957, p. 492
	42	Burgess	1910	Gold, silver	460	USBM production files
	47	Long John	1925-1926	Lead, silver	60,000	Tucker and Sampson, 1938, p. 444
			1939	Lead, silver, copper	300	USBM production files
Unknown location		Daily and Breen	1913	Gold, silver, copper	255	USBM production files

TABLE 1.--Summary of recorded mineral production from mines in and adjacent to the Southern Inyo study area--Continued

Mining district	Map no.	Mine	Principal productive years	Principal commodities	Estimated 1/ value (\$)	Reference
Russ	22	Pinyon-Poorchild-Raven (White Hill)	1889-1890	Gold	4,500	Dimond, 1890, p. 99, Dimond, 1891, p. 103
Swansea	Unknown location	Surprise Package	1935-1942	Gold, silver	1,900	USBM production files
			1879-1880	Silver	5,600	Burchard, 1882, p. 40
	Unknown location	Coal Burner	1889-1891	Gold, silver	94,000	Dimond, 1890, p. 99; Dimond, 1891, p. 103; Dimond, 1892, p. 145
	64	Flagstaff	1889-1891	Silver, gold	300	Dimond, 1890, p. 99;
	61	Pennsylvania	1918-1969	Silver, lead, zinc, gold, copper	23,000	USBM production files
Beveridge	61	Queen of the Mountain	1951	Lead, silver	2,300	USBM production files
			1880	Gold	30,500	Burchard, 1881, p. 29
			1881	Gold	17,000	Burchard, 1882, p. 40
		Keynot	1878-1894	Gold	500,000	Vredenburg and others, 1981, p. 246
		Bighorn	1877-1893	Silver, copper, lead, zinc	8,000-10,000	Vredenburg and others, 1981, p. 246

TABLE 1.--Summary of recorded mineral production from mines in and adjacent to the Southern Inyo study area--Continued

Mining district	Map no.	Mine	Principal productive years	Principal commodities	Estimated 1/ value (\$)	Reference
Cerro Gordo			1866-1934	Lead, silver, zinc	17,000,000	Vredenburg and others, 1981

1/ All dollar values are commulative totals of value of ore at the time of production.

Thousands of miners and prospectors were attracted to the Inyo Mountains by news of these discoveries and swarmed over the range in search of new deposits. Thousands of claims were located and relocated. Most of the mines and prospects in the study area were probably discovered and mined before 1880. Gold-bearing quartz veins were discovered on the east side of the Inyo Mountains in the late 1870's and the Beveridge district was organized soon thereafter. More than \$300,000 worth of gold was produced from the Beveridge district by 1883, principally from the Keynot and Bighorn mines (Buchard, 1884, p. 159).

Mining in the area peaked in the 1880's and thereafter went into a gradual decline. Mining was sporadic during the twentieth century, occurring mostly during the two world wars and the great depression. Virtually no mining has occurred in the area since the early 1950's.

In addition to mining for metallic minerals, there has been considerable mining of nonmetallic commodities in the region. Dolomite marble has been quarried since about 1885 from exposures of Hidden Valley Dolomite along the base of the range adjacent to the southwest margin of the WSA. Marble was originally quarried in blocks for architectural purposes, but it is now marketed in crushed form for roofing granules and soil supplements. Soda ash and other sodium compounds have been extracted from Owens Lake since 1885 (Norman and Stewart, 1951, p. 129-130). A 14-mi tramway carried salt over the Inyo Mountains from Saline Valley to a mill and railhead at Keeler between 1913 and 1930 (Smith and others, 1978, p. 25). The tramway crossed the southern end of the study area (fig 2), and some of the towers, cables, and ore buckets remain. Talc was produced from the Lakeview and Long Trail mines during the 1940's and 1950's. Several thousand tons of quartzite were also removed from outcrops of Eureka Quartzite in the Lakeview mine area between 1956 and 1966 (VerPlanck, 1966, p. 16-17). An occurrence of beryl east of Kern Knob was prospected in the late 1950's and early 1960's (Benson, 1962, p. 2). Pegmatite in the Kern Knob area was prospected for uranium during the 1950's.

In 1985, about 70 lode claims were in the study area, most of them near the Reward and Silver Spur mines. Forty-six lode claims, one placer claim, one millsite, and four patented claims at the Long John mine lie within the excluded portion of the WSA. Another 47 lode claims, 14 limestone placers, 5 millsites, 1 tunnel site, the Brown Monster and Hirsch patents at the Reward mine, and several patented claims owned by the Inyo Marble Company lie near and adjacent to the WSA. Only annual assessment work is being done on most claims.

The only recent activity was the development of a crosscut adit in 1981 to 1984 which was intended to intersect a supposed extension of the Brown Monster vein at the Reward mine. The extension was never found. The effort was abandoned, and the equipment was auctioned in 1984. Apart from intermittent operations at the Inyo Marble quarries and some research and development activity at Owens Lake by Cominco American, Inc., there is no significant mining activity occurring in the area.

MINES AND PROSPECTS

Sixty-six mines and prospects were examined in the course of this study: 41 are within the study area, 10 are within the WSA but outside the study area, and 15 are outside the WSA. Most of the sites are silver-lead-zinc occurrences; gold occurs rarely. Talc occurs at five sites and barite at one (loc. 20, fig. 2). Resources are not identified at any of the mines and prospects.

Most of the mines and prospects can be grouped into five trends or systems: 1) a belt of silver-lead-zinc-gold deposits associated with the Reward anticline, herein referred to as the Reward trend; 2) a major east-trending vein and fault herein named the Silver Spur trend; 3) a belt of quartz veins and gossans associated with the Swansea Wash thrust fault, herein called the Long John trend; 4) a system of silver- and gold-bearing quartz veins, mineralized faults and shears, and limonitic zones in the New York Butte area; and 5) a system of quartz veins in the Hunter Mountain batholith at the north end of the area near the Pat Keyes Trail. Data on all of the sites are summarized in the appendix. The more notable occurrences are described in greater detail in the following sections.

Silver-Gold-Lead-Zinc Deposits on the Reward Trend

The Reward trend extends from the vicinity of the Reward mine about 3 mi southeast through the Pinyon (Poorchild-Raven) mine to the Old Grindstone mine (locs. 16, 22, and 23, fig. 2). Lead, silver, gold, and zinc minerals occur along this zone in veins near the crest of a northwest-trending anticline. The veins are in thinly bedded marble and hornfels of the Keeler Canyon Formation or in the overlying Lone Pine Formation at the Old Grindstone mine. The east limb of the fold is intruded by quartz monzonite and diorite of the Hunter Mountain batholith. Granitic rocks crop out locally as sill- and dike-like intrusives. Near the crest of the anticline, the granitic rocks locally have intruded along the Lone Pine-Keeler Canyon Formation contact.

Reward Mine Area

The Reward mine area (loc. 16, fig. 2) is in the northwest part of the study area in and near Eclipse Canyon (fig. 4). The claim group is accessible by the Manzanar-Reward road to the mouth of Eclipse Canyon. A light-duty dirt road leads about 1 mi to a tunnel that accesses the lower workings of the Brown Monster vein. The principal workings of the Reward mine can be reached by foot up Eclipse Canyon.

The Brown Monster and Hirsch patents as well as the F. D. Roosevelt Nos. 1, 2, and 4, Roosevelt Fraction, Golden West, Apex No. 1, and Judge claims are included in the Reward mine area. Although portals of the main workings on the Brown Monster and Reward (Hirsch) veins are outside the study area, portions of the underground workings extend eastward into

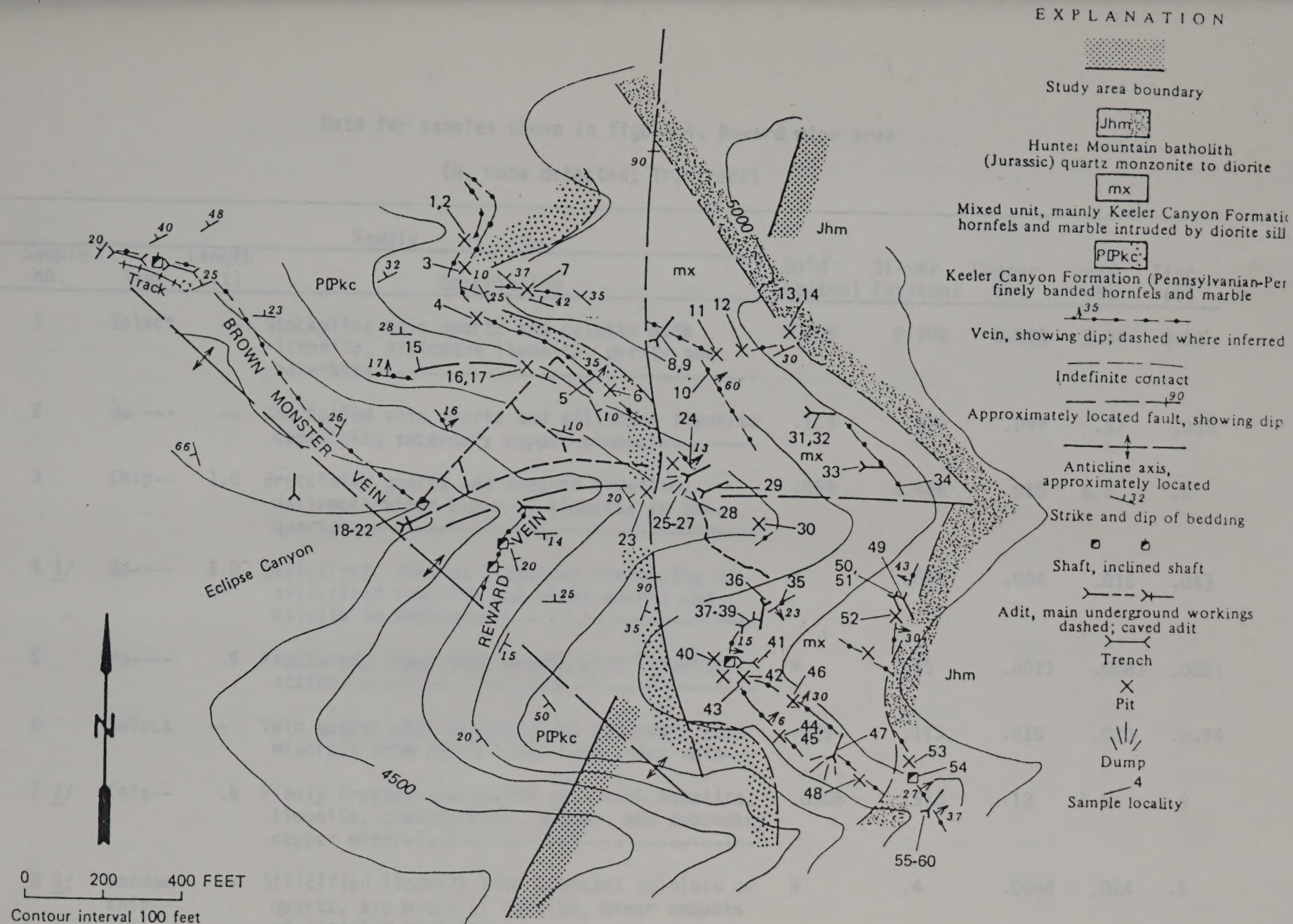


FIGURE 4.—Reward mine area

Data for samples shown in figure 4, Reward mine area

(N, none detected; Tr, trace)

Sample no.	Type	Length (ft)	Sample Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
1	Select	--	Stockpiled vein quartz and calcite with limonite, siliceous limonite, pyrite and malachite-----	0.008	0.308	0.023	0.54	0.23
2	do----	--	Stockpiled vein quartz and siliceous limonite containing secondary copper minerals-----	.114	.379	.092	.57	.039
3	Chip--	1.0	Brecciated quartz and sheared limestone wallrock; minor blebs of limonite in the quartz-----	.069	4.466	.010	6.5	.8
4 <u>1/</u>	do----	5.0	Silicified, sheared limestone consisting of silicified limonite and minor quartz and calcite in veinlets-----	N	.025	.004	.016	.043
5	do----	.6	Fractured, vuggy vein quartz with limonite stains-----	N	.55	.0011	.0083	.0081
6	Select	--	Vein quartz with limonite and secondary lead minerals from 30-ft-long, 1-ft-thick vein---	.089	.113	.010	.020	.0094
7 <u>2/</u>	Chip--	.8	Finely crystalline quartz vein with hematite, limonite, chalcopryrite, galena, and secondary copper minerals-----	.0006	.573	.12	1.8	1.9
8 <u>3/</u>	Random chip--	--	Silicified limonite with abundant veinlets of quartz, and blebs of calcite, minor amounts of specular hematite-----	N	.4	.0066	.024	.6

Data for samples shown in figure 4, Reward mine area--Continued

Sample no.	Sample		Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
	Type	Length (ft)						
9	Chip--	1.5	Sheared granitic and metasedimentary rocks with vein quartz fragments and limonite; from contact-----	0.01	0.3	0.010	0.36	2.0
10	do----	1.3	Quartz with calcite rhombs, limonite, and siderite from a 75-ft-long vein-----	.0008	.030	.0068	.017	.010
11	do----	1.5	Sheared granitic and metasedimentary rocks, vein quartz fragments, and limonite-----	N	.3	.0058	.6	.33
12	do----	1.3	Sheared, silicified, limestone containing fragments of vein quartz and anglesite(?)---	N	2.3	.020	4.6	.8
13	do----	2.1	Sheared, altered granitic rock with limonite and fragments of vein quartz-----	.01	.5	.0093	.63	.28
14	do----	1.8	Sheared, altered granitic rock with vein quartz, siliceous limonite, and calcite-----	N	1.9	.060	2.0	.29
15	do----	.6	Coarsely crystalline vuggy vein quartz with limonite and calcite-----	.0094	.0708	.0035	.028	.030
16	do----	2.6	Vein quartz and siliceous limonite; minor pyrite disseminated in vein-----	.0003	.003	.0038	.0047	.0071
17	do----	3.5	Sheared, argillized metasedimentary rocks in hanging wall near sample 16; limonite stained	N	N	.0041	.0060	.030
18	do----	3.7	Limonite-stained, fractured vein quartz banded with siliceous limonite-----	.003	.1349	.0038	.025	.030

Data for samples shown in figure 4, Reward mine area--Continued

Sample no.	Sample		Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
	Type	Description					
19	Chip--	4.9 Fractured vein quartz with pyrite-----	0.011	0.029	0.0015	0.0080	0.0076
20	do----	3.0 Brecciated and resiliified vein quartz and metasedimentary rock-----	.006	.062	.018	.0096	.0140
21	do----	2.5 do-----	.012	.042	.0014	.011	.0091
22	do----	5.2 Fractured, pyrite-bearing vein quartz and argillaceous selvage-----	.005	.018	.0015	.0092	.0079
23	do----	.4 Quartz vein with pods of galena, chalcopryrite, pyrite, and limonite; along shear zone in limestone-----	.434	9.83	1.1	20.3	.46
24	do----	.8 Milky quartz with galena, limonite, and brown jasperoidal quartz-----	.261	.266	.040	.43	.12
25	do----	2.5 Quartz vein with limonite and green copper stain; in sheared limonite-----	.150	.55	.12	.19	.36
26	do----	1.5 Massive milky quartz with scattered galena crystals up to 0.4 ft and limonite-----	.001	.189	.057	.42	.17
27	do----	1.1 Milky quartz vein with patches of limonite and jasperoidal quartz along contacts-----	.002	.214	.0064	.12	.060
28	Select	-- Milky quartz with galena, secondary copper minerals, limonite, and goethite; from stockpile-----	.298	12.5	.48	23.9	.25

Data for samples shown in figure 4, Reward mine area--Continued

Sample no.	Sample		Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
	Type	Length (ft)						
29	Chip--	2.7	Milky quartz vein with abundant limonite and goethite and minor specks of chrysocolla----	0.001	0.0838	0.029	0.062	0.013
30	do----	1.3	Milky quartz vein with pockets of limonite near hanging wall and foot wall; in diorite	N	N	.0008	.0091	.0042
31	do----	1.1	Argillized granitic rock and 0.2 ft of vein quartz-----	N	N	.0079	.14	.3
32	Select	--	Coarse-grained quartz with galena, limonite, minor chalcopryite, and secondary copper stains-----	.01	6.6	.470	8.4	.086
33	Chip--	1.0	Argillized zone along contact between metasedimentary and granitic rocks-----	N	N	.003	.084	.058
34	do----	1.5	About 0.5 ft of fractured vein quartz and 1.0 ft of argillized granitic rock. The quartz is limonite stained-----	N	N	.0019	.013	.0056
35	do----	3.5	Slightly fractured vein quartz with abundant limonite and minor secondary copper minerals	.01	.1	.017	.049	.0044
36	do----	1.5	Light gray, slightly limonite-stained sheared metasedimentary rock-----	Tr	.1	.0089	.15	.0053
37	do----	.9	Fractured vein quartz with abundant limonite and veinlets of secondary copper minerals---	.08	3.5	.45	3.1	.008

Data for samples shown in figure 4, Reward mine area--Continued

Sample no.	Sample		Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
	Type	Description					
38	Chip--	1.0 Fractured vein quartz cemented with calcite and containing abundant limonite and minor secondary copper minerals-----	1.49	8.1	1.7	1.0	0.014
39	do----	.9 do-----	.57	5.9	.15	2.0	.0096
40	do----	1.8 Sheared, limonite-stained granitic rock with a 0.1-ft-thick quartz vein-----	Tr	--	.024	.296	.030
41	do----	2.5 Sheared, altered granitic intrusive-----	Tr	.3	.0089	.049	.034
42	Select	-- Vein quartz with sooty secondary lead minerals and minor galena, chalcopyrite, and secondary copper minerals; from dump-----	.81	42.0	5.7	29.8	.19
43	do----	-- Limonite-stained quartz and siliceous limonite with secondary copper minerals and pyrite---	.62	10.2	2.4	.87	.026
44	Chip--	2.5 Sheared hornfels, silicified limonite, and quartz in a zone along the contact between metasedimentary and granitic rocks-----	.01	N	.017	.016	.0048
45	Select	-- Milky quartz with limonite and green copper stain; from dump-----	.304	.631	1.8	.16	.030
46	Chip--	2.0 Massive vein quartz with abundant limonite and calcite-----	.14	N	.031	.076	.0049
47	do----	2.0 Massive vein quartz with minor limonite stains and argillized granitic rock-----	N	.1	.26	.11	.045

Data for samples shown in figure 4, Reward mine area--Continued

Sample no.	Sample		Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
	Type	Description					
48	Chip--	2.2 Vein quartz with limonite, siderite, and siliceous limonite-----	N	0.1	0.011	0.075	0.023
49	do----	.4 Vuggy vein quartz with galena, limonite, and secondary copper minerals-----	Tr	4.0	.017	5.4	.025
50	do----	.4 Vuggy vein quartz with galena and limonite---	Tr	4.9	.051	5.0	.23
51	do----	.4 Vein quartz with limonite-----	Tr	.1	.0076	.17	.34
52	do----	1.0 Fractured vein quartz along contact between granitic and metasedimentary rocks; abundant limonite-----	Tr	N	.0041	.019	.0056
53	do----	1.5 Vein quartz and siliceous limonite-----	N	N	N	.0064	.0059
54	do----	2.0 Fractured vuggy vein quartz, galena, limonite and minor secondary copper minerals-----	Tr	3.0	.059	3.7	1.7
55	do----	1.2 Compact, moderately fractured vein quartz with about 5% siliceous limonite, minor calcite-----	N	N	.0018	.034	.011
56	do----	.9 Limonite-stained vein quartz-----	N	N	.0077	.027	.0040
57	do----	.4 Vein quartz with 10% to 20% limonite and minor pyrite-----	0.01	N	.0038	.040	.0015
58	do----	.8 Lightly limonite-stained fractured vein quartz and argillized granitic rock-----	Tr	N	.0050	.032	.0038

Data for samples shown in figure 4, Reward mine area--Continued

			Sample					
Sample no.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
59	Chip--	2.8	Sheared granitic rock-----	N	N	0.0021	0.0019	0.0066
60	do----	.8	Sheared, altered granitic rock with fragments of limonite-coated vein quartz-----	N	N	.0012	.0019	.0026

- 1/ Arsenic 0.0027%
 2/ Molybdenum 0.0054%
 3/ Molybdenum 0.0023%

it (fig. 4). Portions of the other claims are also in the study area. The property was examined to determine if mineralized structures extend into the study area. Time constraints precluded identifying remaining resources in the old Reward and Brown Monster workings.

Gold-silver ores on the property were probably worked by Spaniards prior to 1852 (Johnson and Trengove, 1951, p. 2). In the early 1870's, the Brown Monster was known as the Eclipse claim and had been developed by an inclined shaft and stopes (Goodyear, 1888, p. 263). In 1883 the Brown Monster and the Hirsch mines, adjoining to the south, were patented. The Hirsch mine was being developed as a gold-silver property (Burchard, 1882). Mining activity continued at least intermittently on the properties through the late 1890's. The ores were transported by tram and railway to a mill near the Owens River, about 4.5 mi from the mines. During the late 1890's, the Reward Mining Company operated the Hirsch mine (Crawford, 1896, p. 181). Most of the production from the Hirsch was from 1890 to 1896. After about 1900, the Hirsch and the Brown Monster mines were combined to form the Reward Consolidated Gold Mining Company. Thereafter, the Hirsch was generally referred to as the Reward vein. Activity on the Brown Monster vein continued through the first half of this century, with the longest consecutive years of production occurring from 1938 to 1951. There has apparently been no production since 1951.

Although Burchard (1884, p. 160) states that \$200,000 worth of ore was extracted from the Brown Monster prior to 1884, no accurate estimate of production was found for all claims now included in the Reward mine area. Table 2 includes production records of several properties in the area.

In 1981, Youngquist Mine Development and Consultation, working under a contract with Missouri Mines Inc., began work on a crosscut adit that was driven southward from the canyon north of Eclipse Canyon in order to intersect the Brown Monster vein. The crosscut was driven about 1,700 ft. A raise connected the crosscut to the old Brown Monster workings. By 1984, work had ceased, the equipment had been auctioned, and no further development was planned.

Mineralized zones in the Reward area contain gold, silver, lead, zinc, and copper minerals in generally concordant, shallow-dipping quartz veins. The veins are primarily on the east limb of a northwest-trending asymmetric anticline in the Keeler Canyon Formation. The anticline is intruded to the east by the Hunter Mountain batholith. At least one vein occurs in the margin of the batholith. Near the contact, the Keeler Canyon Formation is intruded by a series of granitic sills, which tend to be concordant with bedding but crosscut it locally. The sills and metasedimentary rocks form a mixed unit bordering the batholith (fig. 4). Two conspicuous faults traverse the property; one trends north, the other east along Eclipse Canyon. Both faults are nearly vertical and both truncate quartz veins.

TABLE 2.--Production from the Reward mine area
(U.S. Bureau of Mines files)

Mine	Year	Gold (oz)	Silver (oz)	Copper (lb)	Lead (lb)
Brown Monster- Eclipse	1889-1901	8,554	57,970	0	0
	1911-1918	2,544	13,450	12,370	64,390
	1929-1951	6,638	30,900	18,520	138,200
Hirsch	1895-1896	1,600	0	0	0
F. D. Roosevelt	1935-1941	23	246	86	717
Golden West	1939	10	17	0	0
Total <u>1/</u> :		19,370	102,600	30,980	203,300

1/ Data may not add to total shown because of independent rounding.

The Brown Monster is the thickest vein exposed on the property. It is as thick as 16 ft in a near-surface stope (Johnson and Trengove, 1951, p. 6), but thins to an average of about 4 ft downdip. The vein strikes about N. 40° W. and dips about 25° NE. near the surface but steepens to over 40° at depth. It consists primarily of massive milky quartz with little sulfide mineralization. Sulfide-rich material was found only in pillars and on walls in the main stopes near the anticline axis. Galena, chalcopyrite, and secondary lead and copper minerals in a quartz-calcite gangue are the principal constituents of the high-grade ore. Outcrops of the vein can be traced northwest of the main portal for about 1,000 ft, but it is bounded on the south by an east-west-trending fault. The vein is exposed downdip for about 540 ft in the workings, but stopes indicate deeper extensions.

The Reward or Hirsch vein is similar in attitude and mineralogy to the Brown Monster and crops out on the south side of Eclipse Canyon about 270 ft from the portal of the Brown Monster. It is also accessible by a crosscut from the Brown Monster workings through the fault zone that truncates the Brown Monster vein on the south. The Reward vein is approximately conformable to the metasedimentary country rock. It extends south of Eclipse Canyon for about 400 ft where it forks and pinches (Knopf, 1918, p. 121). The vein extends downdip to the east about 600 ft where it averages about 4 ft thick in stopes and drifts.

The thickest and highest grade veins are the portions of the Brown Monster and Reward veins nearest the crest of the fold axis. Ore along the axis was largely removed during early mining activities. Stopes and drifts along vein segments on the east limb of the anticline in the study area were observed to be mainly in nearly barren quartz. It is not known with certainty whether the Brown Monster and Reward are segments of the same vein. A small amount of vertical slip along the Eclipse Canyon fault could have produced the observed left-lateral separation on the shallow-dipping vein segments without causing significant separation of more vertical features elsewhere along the fault. However, no corroborating evidence of vertical or left-lateral slip was found.

The Brown Monster vein is developed with a 550-ft inclined shaft and extensive stopes. A 1,700-ft tunnel driven south from the canyon to the north of Eclipse Canyon includes a raise that intersects one of the deeper stopes. The Reward vein is described by Tucker and Sampson (1938, p. 387) as developed with six levels totaling about 4,250 ft of drifts and crosscuts. A seventh level, its portal now caved, includes a 750-ft crosscut accessible from the Brown Monster shaft and 300 ft of drifts. Elsewhere in the area are 12 adits (all less than 120 ft), 5 shafts, and about two dozen prospect pits.

Sixty samples were taken from surface and underground sites (fig. 4). A few of the samples contained notable values of gold, silver, copper, and lead. The richest portion of the vein is near the anticline axis which is outside the WSA. Vein segments in the study area were either too small or too low-grade to constitute resources. If the observed tendency of the veins to be thinner and lower grade away from

the anticlinal axis is true, it would preclude significant mineral resources in the area. Resources were not identified; detailed mapping and sampling of all the workings and systematic drilling would be needed to establish resources.

Pinyon (Poorchild-Raven) Mine

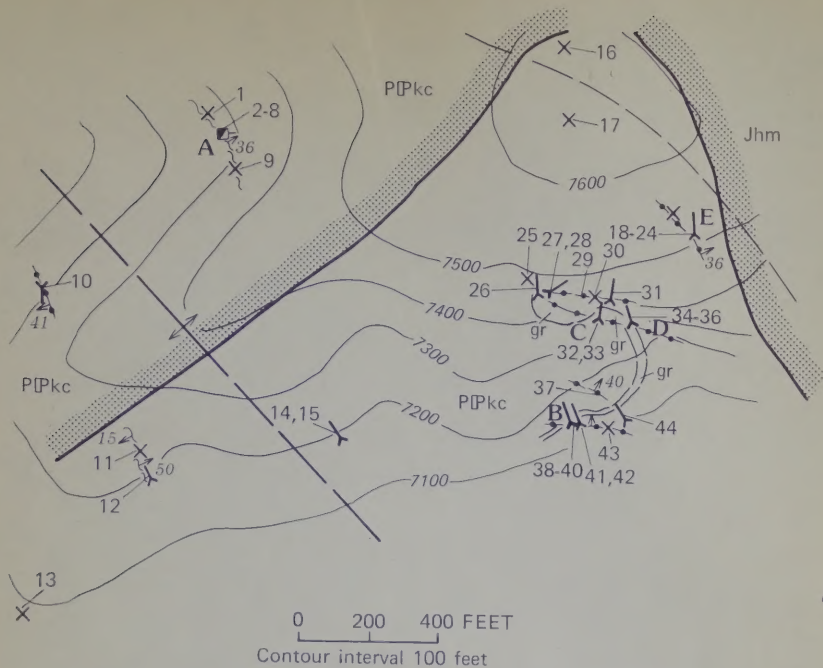
The Pinyon (Poorchild-Raven) claim group (loc. 22, fig. 2) is about 2 mi southeast of the Reward mine atop a steep-sided ridge at elevations of 7,000 to 7,700 ft. It is accessible by a foot trail from the Lucky Slim mine 1.5 mi to the southwest. There are 12 adits, 1 shaft, and 10 prospect pits on the property, with at least 740 ft of underground workings. Most workings are within a few hundred feet of the study area boundary; some are inside (fig. 5).

Artifacts suggest that some of the workings are old. The California State Mining Bureau (1902), p. 8) reports the White Hill mine owned by A. M. Strong of Independence at this approximate location. Gold production of \$4,500 in 1889 to 1890 was recorded for the White Hill mine in the Russ district by Dimond (1890, p. 99 and 1891, p. 103). A location notice of the Poorchild No. 4 claim was found, but the date of location was illegible. BLM files indicate that a portion of the Pinyon group filed in 1965 by Norman D. Norris included most of the workings described here. A location notice for the Raven claim dated 1965 and filed by Brian Howard was found near the workings.

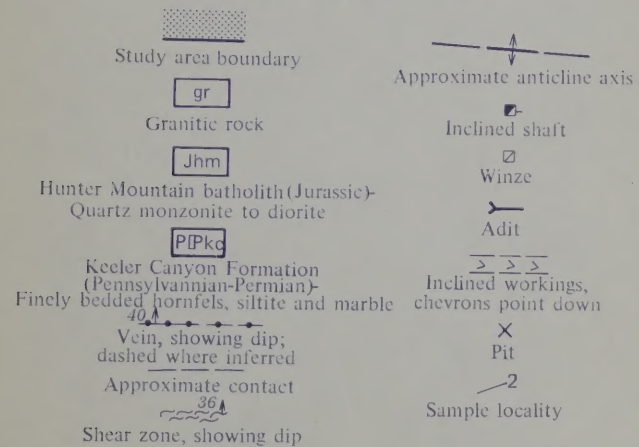
Workings expose a series of quartz veins containing locally abundant galena, chalcopyrite, sphalerite, and pyrite. Many of the veins are brecciated and resilicified, indicating multiple stages of mineralization during deformation. The veins fill fractures in the Keeler Canyon Formation near the axis of the Reward anticline. Some are parallel to bedding, but others are oblique to bedding or nearly parallel to the axial plane of the anticline. The veins are generally exposed for less than 25 ft along strike and are less than 1 ft thick, but four segments were traced intermittently for 100, 110, 150, and 400 ft (fig. 5).

The axis of the Reward anticline is intruded by an irregularly shaped mass of granitic rock that crops out within 500 ft of the mapped area. Bands of coarsely crystalline grossularite occur locally in the Keeler Canyon Formation, but most of the formation near the anticline axis is marble banded with fine-grained hornfels. Granitic dikes and sills occur sporadically.

Forty-four samples were collected (fig. 5). Samples 26 to 28, and 32 to 36, from the 400-ft vein exposure, representing about 4,000 tons of vein material, had weighted averages of 4.9 oz/ton silver, 2.9 percent lead, and 5.0 percent zinc. It averaged 0.5 ft thick where sampled. Samples 20 to 24, from the 150-ft vein, had weighted averages of 4.9 oz/ton silver, 0.6 percent copper, 3.9 percent lead, and 1.4 percent



EXPLANATION



SURFACE
UNDERGROUND

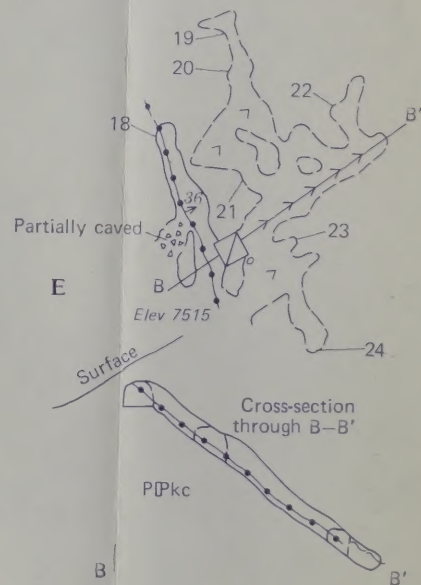
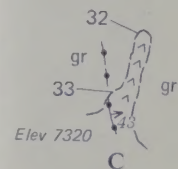
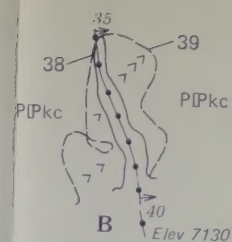
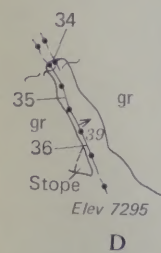
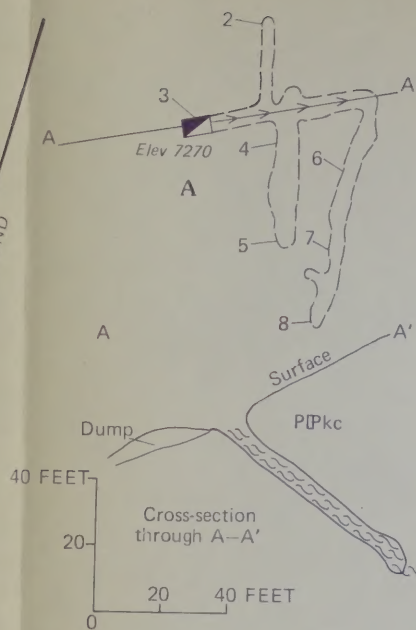
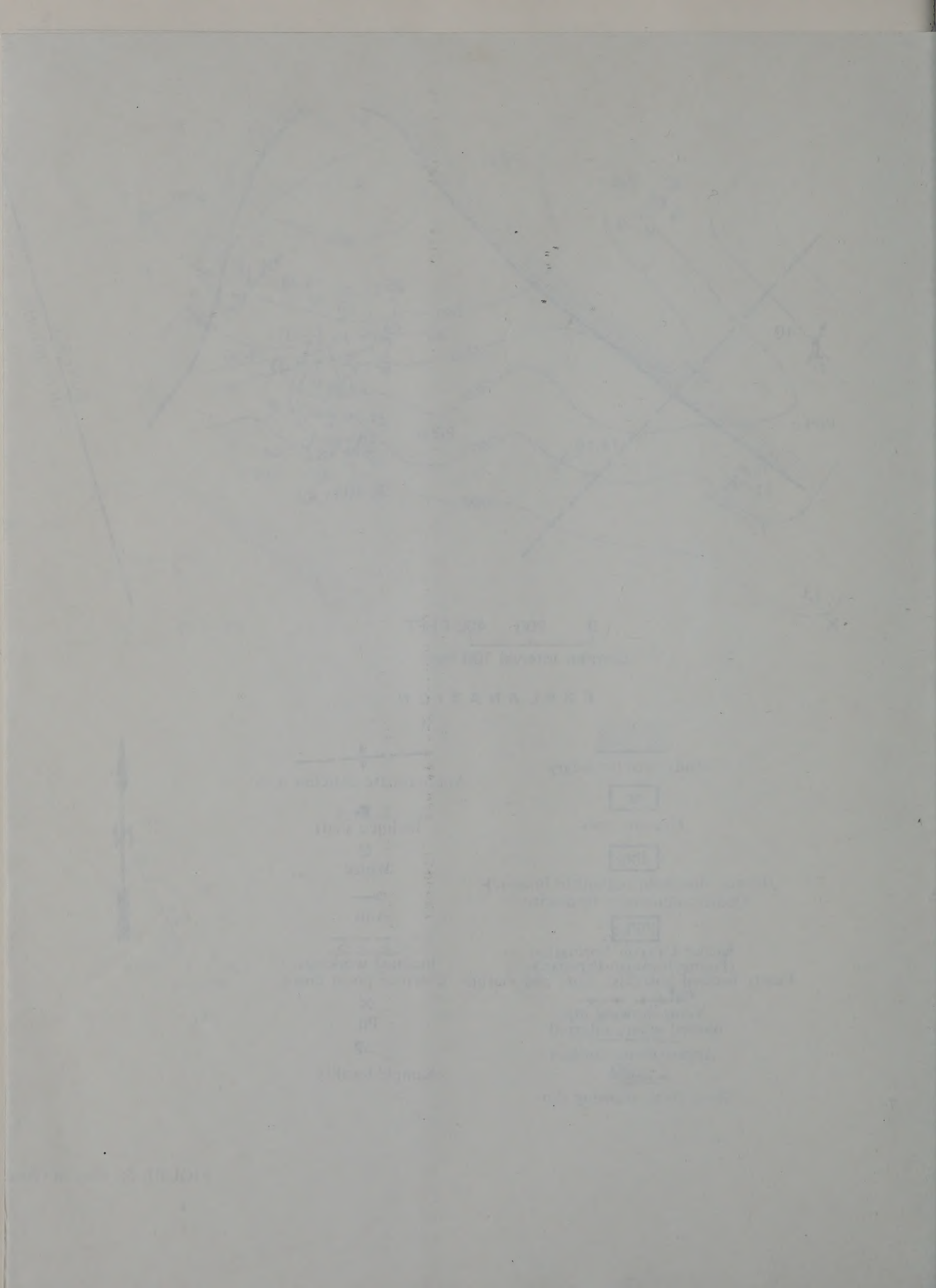


FIGURE 5.—Pinyon (Poorchild-Raven) mine



Data for samples shown in figure 5, Pinyon (Poorchild, Raven) mine

(N, none detected; Tr, trace)

Sample								
Sample no.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
1	Chip--	2.0	Sheared, altered hornfels and dike (?) rock with abundant limonite and minor fragments of vein quartz-----	0.01	N	0.022	0.018	0.032
2	do----	1.0	Limonite-stained vein quartz sampled from altered hornfels and dike(?) rock-----	N	0.1	.0019	.31	.071
3 1/	do----	2.2	Altered hornfels and dike(?) rock with common stringers of banded chalcedony-----	.01	2.2	.021	2.9	2.4
4	do----	3.8	Altered hornfels and dike(?) rock with abundant limonite and common quartz-----	.05	.7	.011	.31	.35
5	do----	1.0	Fractured, altered argillic rock from shear zone-----	Tr	.2	.013	.033	.041
6	do----	2.2	Sheared, altered argillic rock with fragments of quartz and abundant limonite-----	Tr	.2	.0028	.050	.12
7	do----	1.0	Fractured, altered argillic rock with limonite, fragments of quartz, and calcite stringers-----	N	N	.0022	.021	.027
8	do----	1.7	Fractured, altered argillic rock with calcite stringers and limonite-----	N	N	.025	.0079	.0093

Data for samples shown in figure 5, Pinyon (Poorchild, Raven) mine--Continued

Sample no.	Sample		Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
	Type	Description					
9	Chip--	1.2 Sheared, altered hornfels and possible dike rock. Contains about 0.2 ft. of chalcedonic to fine-grained quartz-----	N	N	0.0029	0.033	0.025
10	do----	1.3 Shear zone in marble and hornfels. About 0.8 ft of siliceous limonite with minor calcite and 0.5 ft of coarse-grained quartz and calcite with minor galena occurs as a vein in the shear zone-----	Tr	0.3	.0033	.62	1.1
11	do----	1.5 Fractured limonite-stained hornfels with manganese oxides and minor calcite in a bedding plane shear-----	Tr	N	.0850	.0050	5.0
12	do----	2.5 Massive vein quartz with minor secondary copper minerals and siliceous limonite-----	0.01	1.3	.0170	1.1	1.5
13	do----	3.0 Calcite-quartz vein with seam of galena and minor secondary copper minerals-----	Tr	N	N	.0950	.0063
14	do----	.6 Limonite-stained quartz vein in a marble-hornfels sequence with subordinate amounts of calcite and minor galena-----	.01	2.0	.0320	3.0	.88
15	do----	.8 Vein quartz with siliceous limonite, calcite and minor galena-----	.002	.45	.0210	1.4	2.5
16	Select	-- Vuggy vein quartz with limonite and minor secondary copper minerals-----	N	N	.19	.0018	.0018

Data for samples shown in figure 5, Pinyon (Poorchild, Raven) mine--Continued

Sample no.	Sample		Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
	Type	Length (ft)						
17	Select	--	Hornfels with limonite and minor manganese oxide coatings, and sporadic pyrite-----	Tr	N	0.0067	0.0064	0.0041
18	Chip--	0.7	Calcite vein with about 0.1 ft of quartz in hanging wall; minor limonite-----	0.01	N	.0044	.090	.25
19	do----	.7	Vein quartz with small amounts of limonite and fracture surfaces, and minor galena(?)	N	N	.0027	.032	.026
20	do----	1.0	Vein quartz with galena, chrysocolla, and minor chalcopyrite-----	Tr	13.1	.92	11.0	.0027
21	do----	.7	Fractured vein quartz with quartz cement and minor galena and limonite-----	.06	7.1	.1	5.8	.76
22	do----	1.1	Fractured vein quartz, minor sericite, and chrysocolla-----	Tr	.1	.78	.094	.7
23	do----	.9	Sheared hornfels and possible altered intrusive. Minor silicification, moderate amount of limonite and secondary lead and zinc materials-----	Tr	1.8	.14	2.5	5.6
24	do----	.8	Shear zone with up to 50% subhedral quartz crystals, abundant limonite, and subordinate siliceous limonite-----	N	2.7	.94	.0520	.14
25	do----	.7	Coarsely crystalline, sporadically vuggy vein quartz with chalcopyrite, malachite, chrysocolla, galena and limonite-----	.02	6.4	.88	2.6	.37

Data for samples shown in figure 5, Pinyon (Poorchild, Raven) mine--Continued

Sample no.	Type	Length (ft)	Sample	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
			Description					
26	Chip--	0.1	Vuggy vein quartz with abundant limonite-----	N	0.1	0.0044	0.17	0.14
27	do----	.8	Coarsely crystalline vein quartz, subordinate siliceous limonite, and sporadic galena-----	0.02	10.7	.8	8.3	4.5
28	do----	.6	Coarsely crystalline vein quartz, subordinate siliceous limonite, and sporadic galena-----	.12	.2	.084	1.1	6.9
29	do----	.7	Coarsely crystalline vein quartz with less than 1% galena-----	N	N	.003	.050	.10
30	do----	.7	Coarsely crystalline vein quartz with locally abundant galena, minor chalcopyrite, and chrysocolla-----	N	.7	.011	1.4	.8
31	do----	.3	Vein quartz with locally abundant galena and subordinate chalcopyrite and chrysocolla----	.02	14.2	.45	17.0	.43
32	do----	.6	Fractured altered granitic rock with iron and manganese oxides, and minor vein quartz-----	N	2.8	.21	3.7	4.4
33	do----	.8	Fractured and resilicified vein quartz with sphalerite, galena, and limonite-----	N	2.9	1.3	1.8	2.4
34	do----	.3	Vein quartz banded with limonite-----	N	N	.0023	.062	.044
35	do----	.3	Vein quartz with abundant galena, minor secondary copper minerals, limonite and secondary zinc minerals-----	.02	23.7	.62	2.2	7.1

Data for samples shown in figure 5, Pinyon (Poorchild, Raven) mine--Continued

Sample no.	Type	Length (ft)	Sample	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
			Description					
36	Chip--	0.6	Vein quartz with galena, minor secondary copper minerals, and an efflorescence of white, water soluble mineral (goslarite?)---	N	0.3	0.0240	0.44	10.3
37	do----	1.3	Coarsely crystalline, locally brecciated vein quartz with galena and small amounts of chalcopryite, malachite, chrysocolla, and possibly sporadic linarite and tetrahedrite-----	0.01	13.0	.14	2.9	.26
38	do----	.8	Vein quartz in fractured marble with chalcopryite and secondary copper minerals--	N	.5	.074	.92	.38
39	do----	.8	Brecciated vein quartz containing calcite, limonite after chalcopryite, siliceous limonite, and chrysocolla-----	Tr	.3	1.3	.84	.50
40	Select	--	Coarsely crystalline vein quartz with galena, chalcopryite, and secondary copper minerals from dump-----	N	2.4	.18	1.2	.19
41	Chip--	.4	Fractured vein quartz with minor secondary copper minerals-----	N	.3	.11	.73	.064
42	do----	.2	Coarsely crystalline, translucent, slightly vuggy vein quartz and minor anglesite(?)----	Tr	.1	.0059	.17	.032
43	do----	.3	Vein quartz with a coating of chrysocolla and malachite-----	N	.4	.097	.087	.013

1/ Molybdenum 0.19%

Data for samples shown in figure 5, Pinyon (Poorchild, Raven) mine--Continued

Sample no.	Sample		Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
	Type	Description					
44	Select	-- Vein quartz with sparse galena and copper minerals, and abundant limonite; from dump--	N	4.8	0.39	0.9	0.047

1/ Molybdenum 0.19%.

zinc; the vein averaged 0.9 ft thick where sampled. This vein had been stoped; probably less than 500 tons of vein material remain. The other veins contained silver, lead, and zinc minerals, but the values were low and the veins narrow.

No mineral resources were identified on this property. Several workings of the group have exposed veins which contain silver, lead, and zinc minerals in notable amounts. These veins are narrow, and the distribution of ore minerals erratic. Although additional, and possibly higher grade material, might be discovered by further exploration of known veins, deposits would likely be small. Undiscovered veins may exist in this structural environment, but no evidence of veins large enough to support the high cost of mining and shipping from this poorly accessible property was identified.

Old Grindstone Mine

The Old Grindstone mine (loc. 23, fig. 2) lies about 2.5 mi southeast of the Reward mine and about 0.5 mi southwest of the Reward anticline axis. The claim is entirely within the study area. The workings are from 7,480 to 7,580 ft in elevation. They are accessible by an unimproved road 2.8 mi up Union Wash from the Owenyo-Lone Pine Road and then about 1.5 northerly by foot trail gaining 1,900 ft in elevation. The property is developed by 115-ft, 55-ft, and 8-ft adits, a 20-ft shaft, and three prospect pits. No production record was found for this property. The California State Mining Bureau (1902) described the Keyes mine at this approximate location. It was prospected for silver and lead by owner A. M. Strong of Independence, CA. Several claims were located in this area in the 1920's and 1930's. It was last located May 16, 1973, by Jennifer Roy of Lone Pine who continues to hold the claim.

All but one of the workings are on quartz veins in metasedimentary rocks, mainly impure quartzite of the Lone Pine Formation. One prospect pit on the eastern side of the property is in diorite. Two partially exposed vein segments appear to be parts of a vein that trends N. 30° E. for 850 ft (fig. 6). It is as thick as 5 ft but pinches and swells over distances of a few feet. The vein dips 55° to 65° SE. but locally steepens to 90°. It contains galena and smaller amounts of chalcopyrite and secondary copper minerals. The southwest segment is exposed for about 140 ft along strike and averages 1.3 ft thick where sampled. The northeast segment is 200 ft long and averages 1.5 ft thick where sampled.

Two other exposures of quartz veins with argentiferous galena, pyrite, and secondary copper minerals had been prospected. One is a northeast-trending anglesite(?) -bearing vein that lies about 350 ft northwest and parallels the main vein. The vein is developed with a shaft. The other vein trends east-northeast and lies on the northeast projection of the main vein.

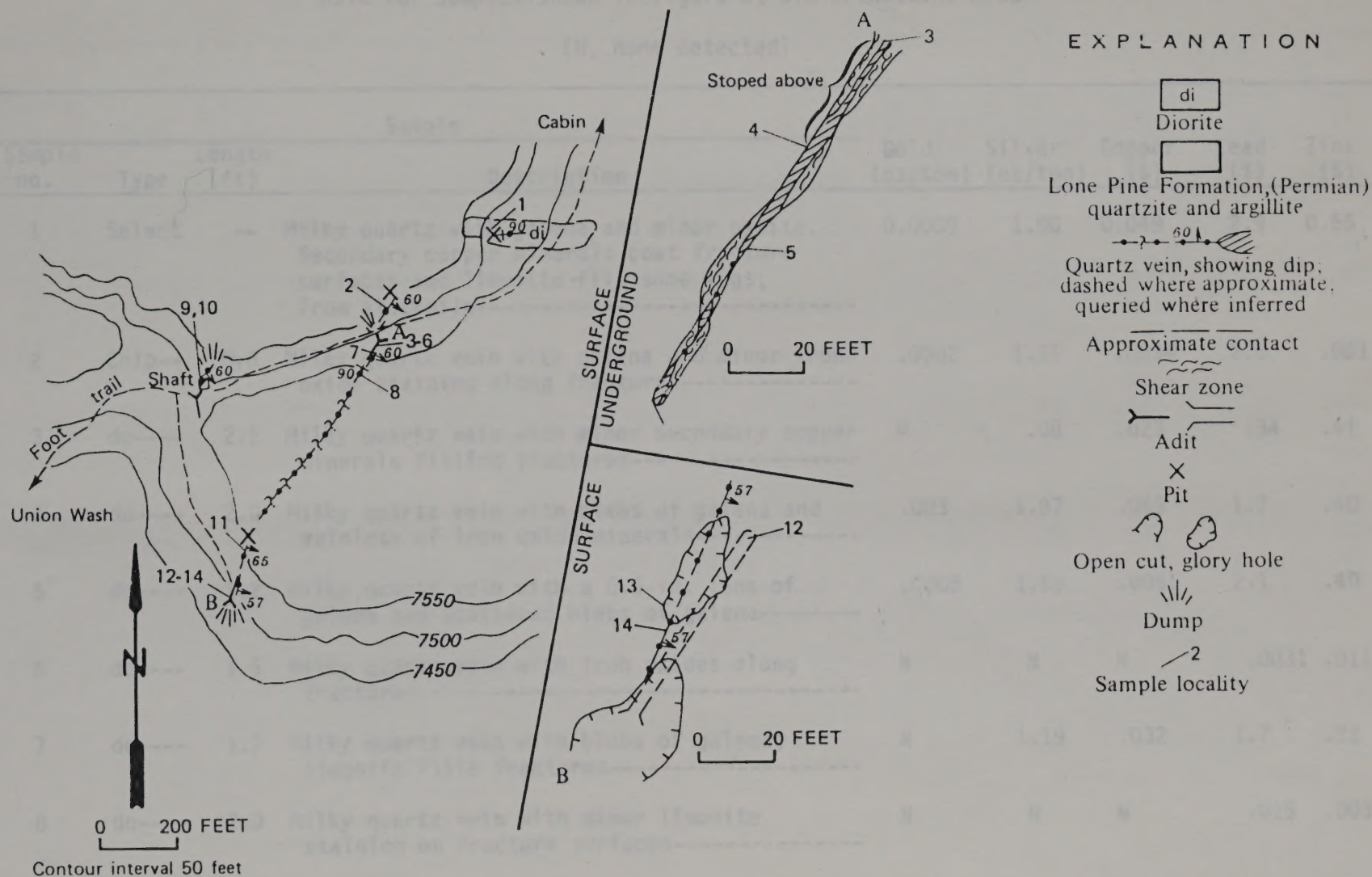


FIGURE 6.—Old Grindstone mine

Data for samples shown in figure 6, Old Grindstone mine

(N, none detected)

Sample no.	Sample		Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
	Type	Length (ft)						
1	Select	--	Milky quartz with galena and minor pyrite. Secondary copper minerals coat fracture surfaces and limonite fill some vugs; from stockpile-----	0.0009	1.90	0.049	2.9	0.65
2	Chip--	0.6	Milky quartz vein with galena and minor iron- oxide staining along fractures-----	.0002	1.11	.0034	2.6	.061
3	do----	2.1	Milky quartz vein with minor secondary copper minerals filling fractures-----	N	.08	.023	.34	.41
4	do----	2.0	Milky quartz vein with blebs of galena and veinlets of iron oxide minerals-----	.003	1.87	.065	1.7	.40
5	do----	1.2	Milky quartz vein with a 0.5-in. lens of galena and scattered blebs of galena-----	.0006	1.50	.0051	2.1	.40
6	do----	1.5	Milky quartz vein with iron oxides along fractures-----	N	N	N	.0031	.011
7	do----	1.7	Milky quartz vein with blebs of galena; limonite fills fractures-----	N	1.19	.032	1.7	.22
8	do----	2.0	Milky quartz vein with minor limonite staining on fracture surfaces-----	N	N	N	.015	.0037

Data for samples shown in figure 6, Old Grindstone mine--Continued

Sample no.	Type	Length (ft)	Sample	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
			Description					
9	Select	--	Milky quartz with galena and secondary copper minerals from stockpile. Black, powdery material, probably anglesite, fills fractures	0.006	17.1	1.5	18.3	0.054
10	Chip--	5.2	Milky quartz with galena veinlets and secondary copper minerals filling fractures	.0009	2.03	.042	3.1	.057
11	do----	.5	Milky quartz vein with galena-----	N	.08	.0078	.090	.012
12	do----	2.0	Milky quartz vein with chalcopryrite veinlets	.0002	.39	.27	.22	.024
13	Select	--	Milky quartz with galena and secondary copper minerals; from stockpile-----	.008	13.0	.19	14.5	.022
14	Chip--	1.3	Milky quartz vein with secondary copper minerals and limonite staining along fractures-----	N	.09	.011	.088	.0091

Eleven chip and three select samples were collected (fig. 6). The north and south exposed vein segments average 0.92 and 0.25 oz/ton silver, and 1.2 and 0.16 percent lead, respectively. If the two segments are continuous, then 18,000 tons of vein material could be present. The grades of mineralized zones on the property are too low and variable and the veins too thin to be minable. If the richer material from the stockpiles is representative, then some high-grade pockets may still exist. However, additional mapping and sampling in conjunction with geophysical surveys would be required to disclose resources.

Silver-Lead-Zinc Deposits on the Silver Spur Trend

The Silver Spur trend is a mineralized fault and shear zone that extends 2 mi eastward from the base of the Inyo Mountains (fig. 7). It trends N. 80° to 85° W. and dips 55° northward to steeply southward. The western half of the trend, which includes the Silver Spur and Cheri No. 20 properties (locs. 24 and 25, fig. 2), is highly mineralized in silver, lead, and zinc. This portion of the trend is hosted by Permian and Triassic shales and limestones. The weakly mineralized eastern extension is in the Lone Pine Formation of Permian age. The entire trend is within the WSA, but only the eastern half is in the study area.

Silver Spur Mine

The Silver Spur mine (loc. 24, fig. 2) is located within the WSA about 0.5 mi outside of the western boundary of the study area on the low ridge north of Union Wash. It is near the base of the Inyo Mountains at elevations of 4,100 to 5,500 ft in moderate terrain. It is accessible by an unpaved road from the Owenyo-Lone Pine road. The owners refused permission to examine the deposit; the following discussion is based on published reports.

The Silver Spur mine is the former Union mine originally located between 1860 and 1862 in the Russ mining district by the Union Mining Company (De Decker, 1966; Goodyear, 1888). Between 1888 and 1965, the mine had several owners and operators including the Whitney-Union, Hollinger, and Big Wedge Mining Companies, the Monte Carlo and Keeler Gold mines, Inc., and numerous individuals. The current owners located the Silver Spur No. 1-3 mining claims in 1965 and 1967. The Big Wedge claims located in 1981 by Paul Skinner appear to overlap the Silver Spur claims.

Goodwin (1957) reported that production from the Monte Carlo mine prior to 1902 was over 100,000 oz (troy ounce) of silver. Additional unrecorded amounts of silver, gold, lead, and copper ore were shipped from the Mt. Whitney, Union, and Monte Carlo mines between 1902 and 1939.

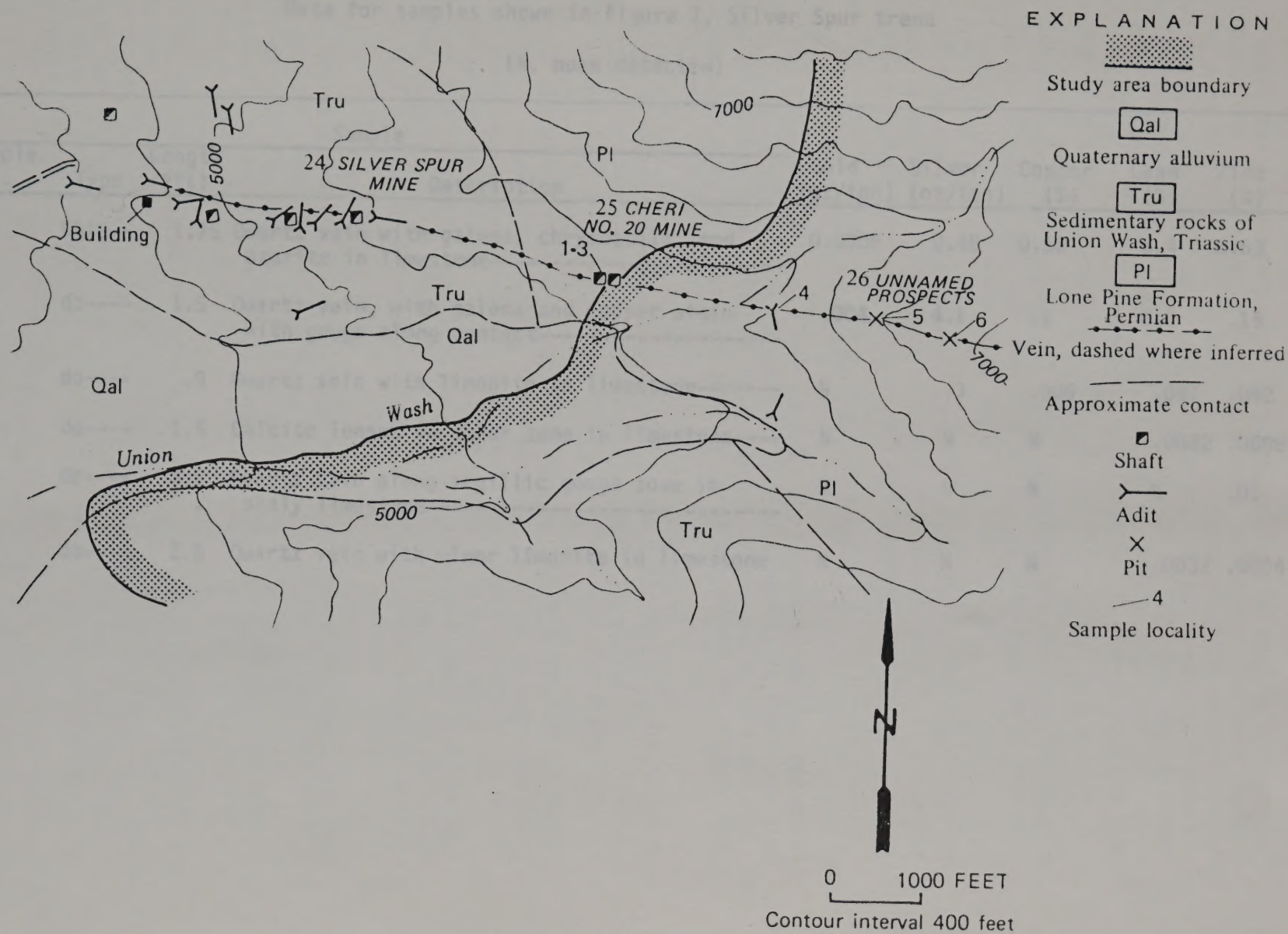


FIGURE 7.—Silver Spur trend

Data for samples shown in figure 7, Silver Spur trend

(N, none detected)

Sample			Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	
Sample no.	Type	Description						
1	Chip--	1.75	Quartz vein with galena, chrysocolla, and azurite in limestone-----	0.0006	0.48	0.56	6.4	0.53
2	do----	1.5	Quartz vein, with galena and copper stain with gouge along contact-----	.004	4.1	.1	6.0	.15
3	do----	.9	Quartz vein with limonite in limestone-----	N	.3	.006	.097	.042
4	do----	1.5	Calcite lenses in shear zone in limestone----	N	N	N	.0082	.0098
5	do----	3.2	Quartz vein along argillic gouge zone in shaly limestone-----	N	N	N	N	.01
6	do----	2.6	Quartz vein with minor limonite in limestone	N	N	N	.0032	.0004

A generally east-striking, north-dipping quartz vein is exposed for 4,000 ft along workings in Triassic marine sediments. The vein is in a shear zone concordant to bedding of thin layers of alternating limestone, calcareous siltstone, and shale. It extends across a wash for another 2,000 ft where it is exposed for about 200 ft at the Cheri No. 20 mine (Tucker, 1926, p. 502). The vein strikes N. 70° E., dips 60° to 65° NW., and is 6 to 20 ft thick. Ore minerals include galena and lead carbonate (Tucker and Sampson, 1938, p. 457).

Tucker and Sampson (1938, p. 457) reported the vein was developed by 3,000 ft of underground working in 8 adits. The foundation of the old mill and a loading bin also remain.

The Silver Spur mine was not mapped or sampled in the course of this study. High-grade silver-bearing veins may remain, but it is not known if there is sufficient tonnage to warrant reopening the mine.

Cheri No. 20 Mine

The Cheri No. 20 mine (loc. 25, fig. 2) is on the eastern extension of the Silver Spur structure (fig. 7). It is located on the study area boundary on the north side of Union Wash at an elevation of 5,600 ft. It is accessible by an unimproved road up Union Wash from the Owenyo-Lone Pine road and a foot trail.

The mine was probably developed at the same time as the Silver Spur mine. It was once part of the Union mine claim group and was known as the Little Bill (Tucker, 1926, p. 502); production is undetermined.

At the main shaft, a quartz vein, 0.9 to 1.8 ft thick and averaging 1.4 ft, is exposed for 135 ft along strike. It is generally concordant to thinly bedded limestone of the Lone Pine Formation; strike is N. 85° E., and dip is 65° NW. The vein is enclosed by a 4-ft-thick argillized, slightly limonitic zone in the limestone, and it contains argentiferous galena, chrysocolla, and azurite. Tucker (1926, p. 502) reported a grade of 24 oz/ton silver, 30 percent lead, and 0.24 oz/ton gold.

The main working is a two-compartment inclined shaft which was said to be 75 ft deep (Tucker, 1926, p. 502). The shaft is open and well timbered for at least 50 ft and probably has more than 100 ft of workings. A second shaft, 110 ft east of the main shaft on the same vein, is about 50 ft deep.

A second quartz vein exposure is 3,000 ft east of the main shaft across Union Wash on the nose of a ridge (loc. 26, fig. 2). The vein crops out for at least 1,000 ft along an easterly trend (fig. 7). Where measured in two places, the vein is 2.6 and 3.2 ft thick. The vein strikes N. 78° E., dips 76° NW., and is enclosed in argillically altered limestone and gouge.

Two small prospect pits are on the eastern vein exposure. One adit is near the base on each side of the westerly trending ridge. The adits were probably intended to intersect the vein but did not. The adit on the north side was driven 30 ft S. 10° E. in locally sheared but apparently unmineralized limestone; the south adit was driven 10 ft northeast in limestone.

Three samples were taken from surface exposures of the quartz vein at the Cheri No. 20 (fig. 7). The samples averaged 1.75 oz/ton silver and 4.89 percent lead. Three samples from the prospect pits and adits on the eastern vein segment had no significant metal content.

Surface exposures suggest that the vein is too narrow and too low in metal content to comprise a resource. The underground workings should be mapped and sampled in detail before more definitive conclusions can be made. The eastern vein segment is apparently barren.

Silver-Lead-Zinc Deposits on the Long John Trend

A belt of gossan zones and quartz veins extends 2.5 mi along a N. 30° W. trend between the Long John mine (loc. 47, fig. 2) and the Copper Summit prospect (loc. 58, fig. 2). The zone is in Hidden Valley Dolomite adjacent to a thrust fault contact with Rest Spring Shale to the northeast. The Long John mine, a past producer of silver and lead, at the northwest end of the belt, is in a pipelike body of secondary silver-lead minerals, iron oxides, and clay which apparently filled a solution cavity in the dolomite. The surface expression of the Long John deposit is a limonitic gossan zone. Similar gossans, evidence of open joints enlarged by solution, and small areas of internal drainage occur along the zone south of the Long John mine. Prospects along the trend are described in the appendix of this report (loc. nos. 48-53). The Long John mine and Copper Summit prospect are described in more detail herein.

Gossans are bodies of mostly iron oxides and are often the remains of an ore body that has been leached during weathering. They may signify the presence of an ore body at depth below the zone of leaching. Although sample data from the gossans are not very encouraging, the results do indicate that mineralization has occurred and that other deposits like the Long John could exist.

Long John Mine

The Long John mine (loc. 47, fig. 2) is situated on a ridge on the south side of Long John Canyon in moderate terrain at an elevation of about 7,200 ft. The mine area is accessible by a four-wheel-drive road that extends up Long John Canyon, although the road was impassable beyond the Black Warrior mine in 1985.

The Long John mine consists of four mining claims which cover about 78 acres. The claims were patented in 1923. The mine operated in 1925 to 1926 under the ownership of the Inyo Lead Syndicate of Las Vegas, NV, which shipped \$60,000 worth of ore that reportedly contained 40 oz/ton silver and 40 percent lead (Tucker and Sampson, 1938, p. 444). Ownership was transferred to James A. Walker in 1938. In 1939, 23 tons of ore containing 203 oz silver, 2,733 lb (pound) of lead, 333 lb of copper, and some gold were shipped. By 1940, H. E. Woodson had leased the mine and made a shipment of ore to Midvale, UT (Tucker and Sampson, 1940, p. 26).

The mine is in a lenticular body of dolomite, limestone, quartzite, and argillite of the Hidden Valley Dolomite which is bounded by Rest Spring Shale (fig. 8). Bedding strikes northwest and dips steeply to the northeast and southwest. A younger felsite porphyry dike trends east-west across the area.

The mineralized zone is a pipelike structure in a fissure vein that extends from the surface to a depth of about 230 ft where it appears to pinch out. It is 6 to 8 ft wide, 4 to 6 ft thick, strikes N. 30° W., and dips 60° NE. It consists of massive, light brown, argillic material that contains galena, lead and iron carbonates, calcite, limonite, clay, and quartz. Numerous open solution cavities in the wall rock are lined with travertine.

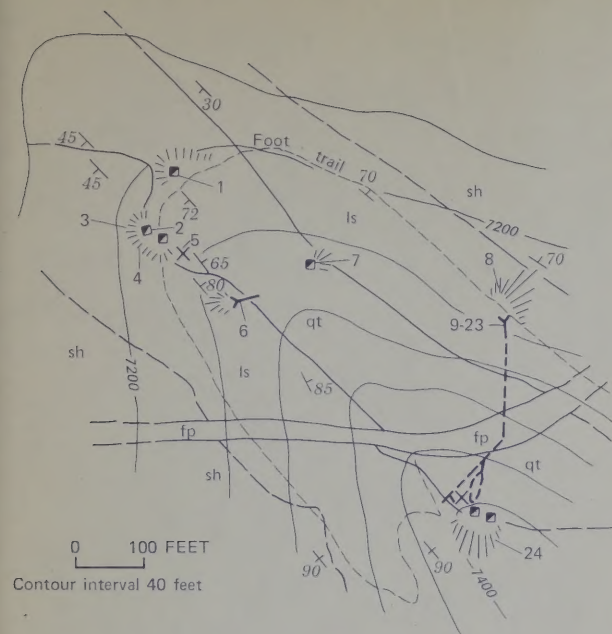
The principal workings consist of a 195-ft crosscut to the fissure vein, and an additional 270 ft of exploratory drifts. The deposit was mined by means of a 75-ft-deep winze and a 65-ft-high raise to a stoped chamber, from which an 80-ft raise reaches the surface (fig. 8). Other workings include a 20-ft adit developed on an exposure of iron oxide, quartz, and iron carbonate in dolomite, four inaccessible shafts, and several prospect pits.

Seven chip samples from the fissure vein averaged 2.14 oz/ton silver, 1.27 percent lead, 0.50 percent copper, 0.139 percent zinc, and 0.048 oz/ton gold (fig. 8). Three of these samples averaged 0.215 percent tin. Seventeen samples from other structures, altered zones, and dumps on the property contained no significant values.

An estimated 6,000 to 7,000 tons of material were removed from the fissure vein. The deposit is mined out.

Copper Summit Prospect

The Copper Summit prospect (loc. 58, fig. 2) is on a ridge top in the southern part of the study area at an elevation of 6,800 to 7,040 ft. It is accessible by road from the site of Alico to the Lakeview talc mine, and then by foot up the canyon. The history is unknown; the property was only mentioned by Tucker and Sampson (1938, plate 3). There is no evidence of past production.



Data for samples shown in figure 8, Long John mine

(N, none detected)

Sample no.	Sample		Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
	Type	Description					
1	Random chip--	-- Shear zone with clay gouge, boxwork limonite, and quartz veins-----	0.034	0.601	0.045	0.31	0.35
2	Select	-- Dark brown cellular limonite-hematite gossan with copper stain and calcite veins; from dump-----	.018	1.69	.15	1.3	.97
3	do----	-- Quartz vein material with copper stain, galena, and limonite; from 1 ton stockpile--	.0072	6.22	.31	6.1	4.4
4	Grab--	-- Siliceous limestone, limonite gossan, and clay gouge; from dump-----	.008	.67	.053	.96	1.7
5	Chip--	4.5 Shear zone with quartz veinlets, limonite, and clay gouge-----	.0015	.54	.011	.48	.47
6	Random chip	-- Brecciated limestone with clay and calcite veinlets-----	.0005	.086	.0062	.054	.053
7	Select	-- Stockpile of silicified limestone and limonite gossan-----	.004	.051	.0024	.017	.076
8	Grab--	-- Silicified limonite gossan and quartz, and diorite dike material; from dump-----	.02	.585	.20	1.1	.076
9	Chip--	2.7 Diorite dike and clay gouge with limonite and talc-----	.018	.533	.017	.046	.17

Data for samples shown in figure 8, Long John mine--Continued

Sample no.	Sample		Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
	Type	Description					
10	Chip--	3.3 Shear zone with diorite dike, siliceous limestone, and clay gouge-----	N	0.038	0.0009	0.0032	0.0011
11	do----	3.5 Shear zone with silicified limestone, and limonite and clay gouge-----	N	1.3	.29	.25	.44
12	do----	2.2 Shear zone with silicified, brecciated limestone, and sooty limonite-----	N	.089	.0018	.013	.019
13	Select	-- Sooty limonite in zone 5 ft long and 0.4 ft wide-----	0.0026	.646	.034	.30	.23
14	Chip--	2.2 Zone of silicified limestone, calcite, siderite, and clay gouge-----	N	.032	.0008	.0062	.01
15	do----	3.2 Shear zone with silicified limestone, limonite, and clay gouge-----	.0007	.032	.0045	.012	.013
16	do----	1.0 Zone of limonite, siderite, and brecciated limestone-----	.0025	.047	.0085	.022	.017
17	do----	3.0 Fracture zone in silicified, brecciated limestone-----	.0013	.028	.0011	.0021	.012
18	do----	5.0 Fissure vein with quartz, calcite, siderite, powdery limonite, siliceous limonite, and sheared limestone-----	.009	4.41	1.2	1.8	.16
19 <u>1/</u>	do----	1.0 do-----	.0033	1.34	.57	.55	.099

Data for samples shown in figure 8, Long John mine--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
Sample no.	Type	Length (ft)	Description					
20 <u>2</u> /	Chip--	3.0	Fissure vein with quartz, calcite, siderite, powdery limonite, siliceous limonite, and sheared limestone-----	0.078	3.53	0.12	4.6	0.071
21 <u>3</u> /	do----	3.3	do-----	.042	3.04	.22	.59	.079
22	do----	3.0	do-----	.085	.993	.18	.31	.04
23	do----	4.0	do-----	.12	.35	.94	.78	.086
24	Select	--	Dark brown cellular limonite-hematite gossan with copper stain; from 1-ton stockpile-----	.055	10.97	1.1	7.8	.077

1/ 0.169% tin.

2/ 0.245% tin.

3/ 0.232% tin.

The mineralized zone is a gossan of massive black, brown, yellow-brown, and red iron oxides, chiefly goethite. The zone is about 480 ft long and as thick as 5 ft, but it pinches and swells forming discrete pods (fig. 9). At the crest of the ridge, the gossan contains secondary copper minerals including malachite, azurite, chrysocolla, turquoise, and native copper. Copper minerals comprise about 5 percent of the gossan. Impressions of bladed crystals up to .05 ft long in the gossan might be the molds of cerussite crystals. These are associated with a bright red mineral which might be lead oxide. At the north and south ends of the zone, copper and lead minerals are absent.

The gossan zone is in massively bedded Hidden Valley Dolomite which is highly deformed. Bedding is contorted into drag folds, and more resistant quartzite beds are disrupted into discontinuous blocks. The mineralized zone is 100 to 200 ft east of the Swansea Wash thrust which separates the dolomite from Rest Spring Shale. A chloritized mafic dike lies parallel to the gossan, and at one point is in contact with it. The gossan is explored by seven prospect pits and cuts and two shallow shafts.

Four chip samples from outcrops and five grab samples from stockpiles and dumps were collected (fig. 9). Samples contained as much as 14.9 percent copper; other metals are negligible. Two samples, nos. 7 and 8, contained 0.22 percent and 0.33 percent arsenic, respectively, and one, no. 8, contained 0.11 percent vanadium.

There is no evidence that the gossan zone contains minable resources. However, the gossan might be a leached capping of a sulfide ore deposit at depth. Geophysical surveys followed by drilling would disclose if resources are present.

Gold-Silver Veins in the New York Butte Area

The area from New York Butte southward to Burgess Well lies along the eastern study area boundary (fig. 10) and includes the Burgess mine area (loc. 42), the Million Dollar Baby prospect (loc. 41), the Macaroon prospect (loc. 40), and unnamed prospects (locs. 37, 38, and 39). The prospects at localities 43 and 44 are described in the appendix. The northern part of this area is underlain by quartz monzonite of the Hunter Mountain batholith, and the southern part, including the Burgess mine area, by Triassic volcanic and sedimentary rocks.

The Burgess mine produced gold and silver from a quartz vein along a bedding plane fault that strikes N. 20° W. and dips 35° to 50° SW. The fault is within a system of weakly mineralized joints which trend N. 25° E., dip 90°, and trend N. 55° W., dip 80° NE. (McGirk and MacKevette, 1950). The mineralized zone is 80 to 100 ft wide and trends northwest 3,800 ft to the base of New York Butte. Our observations suggest the trend may extend at least 1.5 mi across the west flank of New York Butte and well into the study area.

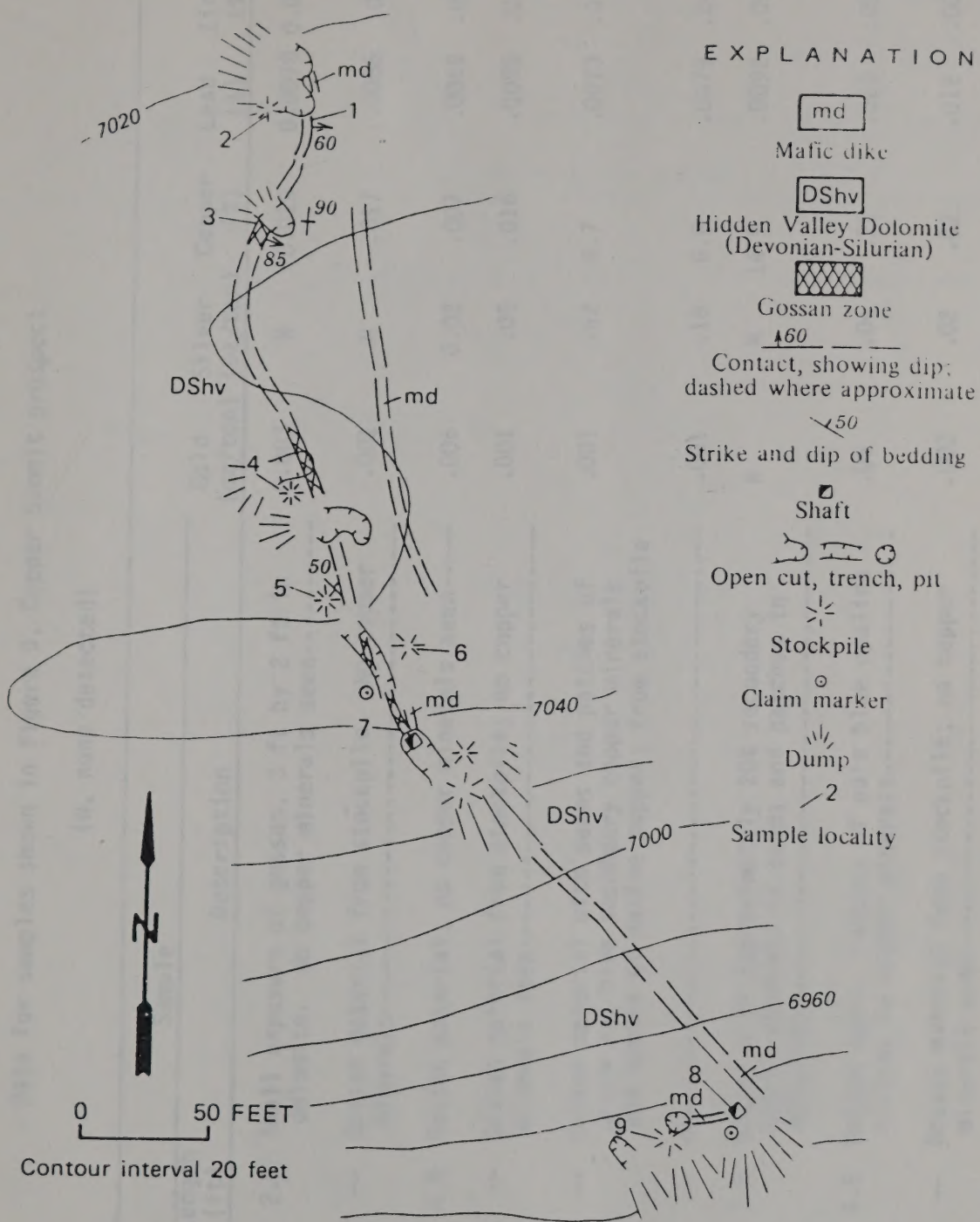


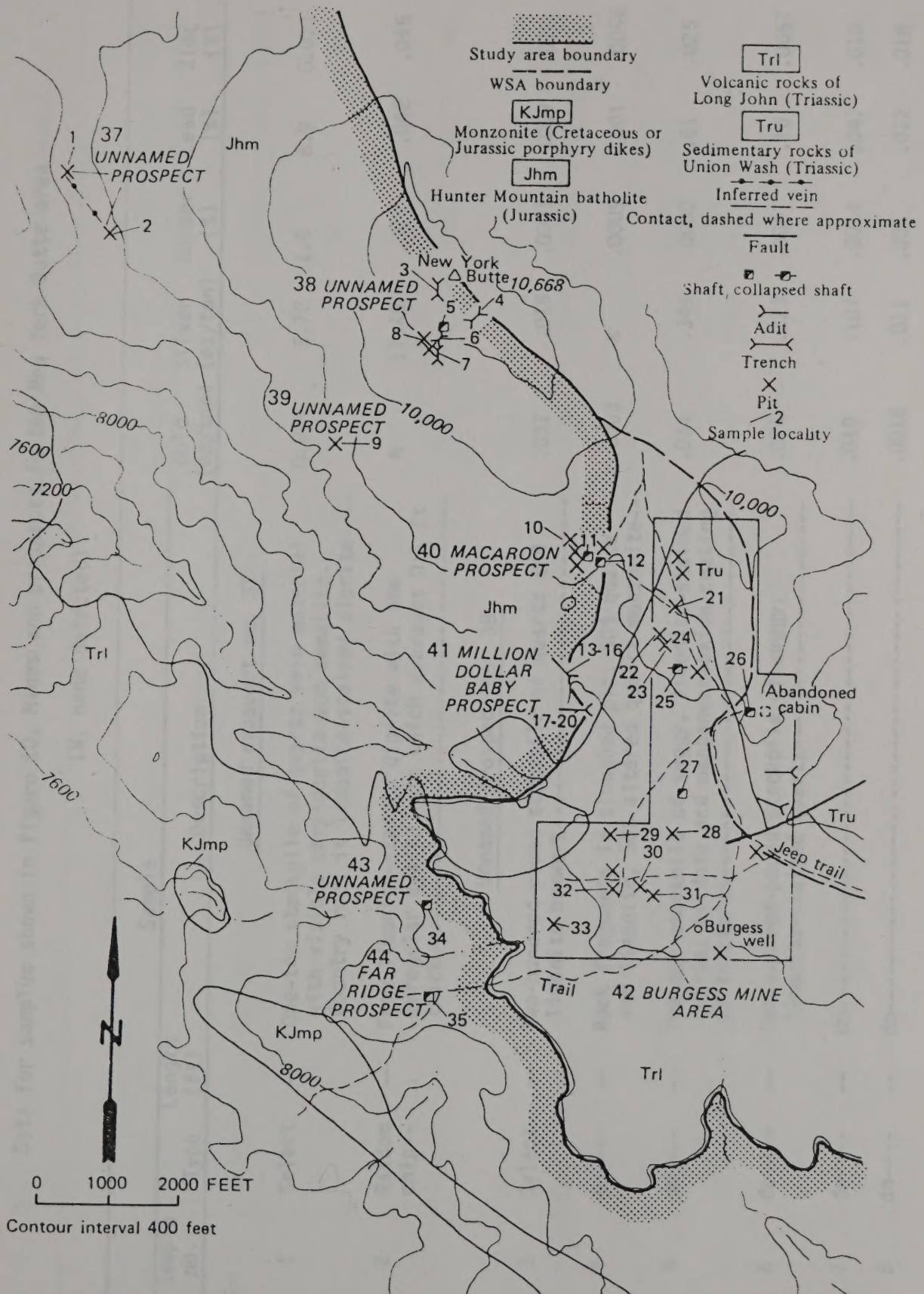
FIGURE 9.—Copper Summit prospect

Data for samples shown in figure 9, Copper Summit prospect

(N, none detected)

Sample					Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
Sample no.	Type	Length (ft)	Description						
1	Chip--	2.9	Small exposure of gossan, 3 ft by 2 ft in dolomite. No copper minerals seen-----		0.003	N	0.019	0.0078	0.013
2	Grab--	--	Gossan material from stockpile. No copper minerals-----		.001	N	.017	.0086	.0078
3	Chip--	4.0	Gossan material; no copper minerals seen-----		.006	0.02	.007	.0069	.0092
4	Grab--	--	Gossan material from stockpile; no copper minerals seen-----		.001	.05	.016	.0095	.0088
5	do----	--	Gossan material with seams and patches of green and blue secondary copper minerals and specks of native copper; from stockpile		.001	.62	9.7	.0073	.03
6	do----	--	do-----		.001	.18	6.9	.0079	.049
7	Chip--	1.6	Gossan with approximately 20% secondary copper minerals in seams and patches in dolomite-----		N	N	14.9	.0092	.058
8	do----	4.5	Gossan zone. Patches of pale blue opaline silica; no copper minerals-----		.06	.04	.22	.023	.0069
9	Grab--	--	Gossan material from stockpile; no copper minerals seen-----		.003	.02	.02	.012	.0063

EXPLANATION



Geology from Conrad (1986)

FIGURE 10.—Mines and prospects in the New York Butte area

Data for samples shown in figure 10, Mines and prospects in the New York Butte area

(N, none detected)

Sample					Gold	Silver	Copper	Lead	Zinc
Sample no.	Type	Length (ft)	Description		(oz/ton)	(oz/ton)	(%)	(%)	(%)
<u>Unnamed prospect no. 37</u>									
1	Select	--	One-ton stockpile of quartz vein material with visible chrysocolla and hematite. Country rock is limonite-stained diorite----		0.084	5.72	1.9	8.9	0.021
2	Random chip--	--	From limonite-stained diorite with one irregular quartz vein which averages 0.1 ft thick-----		N	17.40	.36	.042	.046
<u>Unnamed prospect no. 38</u>									
3	Select	--	Two-hundred-pound stockpile of quartz and limonite boxwork-----		.032	.019	.0021	.007	.018
4	do----	--	Rock fragments in sloughed pit; 50% quartz and limonite, 50% altered quartz monzonite--		.0003	N	.0009	.001	.0056
5	do----	--	Two-ton stockpile of vuggy, limonite-stained quartz; epidote and manganese-oxide coating on fractures-----		.034	.344	.0083	.61	.025
6	do----	--	Two-hundred-pound stockpile of vuggy, limonite-stained quartz-----		.074	.223	.0041	.16	.0057
7	do----	--	do-----		.019	.107	.0014	.047	.010
8	do----	--	do-----		.0016	.011	.001	.012	.018

Data for samples shown in figure 10, Mines and prospects in the New York Butte area--Continued

Sample			Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
Sample no.	Type	Length (ft)						
<u>Unnamed prospect no. 39</u>								
9	Select	--	One-hundred-pound stockpile of brecciated quartz and limonite; one small bleb of pyrite or chalcopyrite; epidote along fractures in granitic country rock around stockpile-----	0.0044	0.0721	0.0026	0.066	0.038
<u>Macaroon prospect</u>								
10	do----	--	From 200-pound stockpile of limonite-stained quartz vein material-----	.006	.221	.0027	.81	.066
11	do----	--	do-----	.008	.091	.0019	.12	.059
12	do----	--	do-----	.038	.788	.072	2.0	.29
<u>Million Dollar Baby prospect</u>								
13	Chip--	6.0	Altered granitic intrusive and clay gouge in shear zone-----	N	N	.0066	N	.0073
14	do----	.3	Clay gouge with 0.1 ft quartz vein-----	N	.088	.091	.0049	.0081
15	Random chip--	--	Altered granitic intrusive with diorite inclusions-----	N	N	.0021	N	.0048
16	do----	--	Altered granitic intrusive-----	N	N	.0007	N	.0041

Data for samples shown in figure 10, Mines and prospects in the New York Butte area--Continued

Sample			Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
Sample no.	Type	Length (ft)						
Million Dollar Baby prospect--Continued								
17	Chip--	1.1	Quartz vein with limonite, pyrite, galena, chrysocolla, malachite, and clay gouge-----	0.011	3.85	0.078	2.5	0.30
18	do----	.9	do-----	.002	1.52	.036	.76	.15
19	do----	.8	do-----	.011	2.19	.016	1.0	5.5
20	do----	.4	do-----	.001	1.02	.064	1.5	.12
Burgess mine area								
21	Grab--	--	Bleached, fine-grained quartzite from dump--	N	.085	.002	.015	.008
22	Select	--	Brecciated quartz vein material with limonite from dump-----	N	.15	.0034	.20	.30
23	do----	--	do-----	N	8.5	.076	3.4	.35
24	Grab--	--	Limestone and skarn from dump-----	N	.016	.027	.018	.011
25	Select	--	Brecciated quartz vein material with limonite from dump-----	.0002	3.3	.0045	4.8	1.6
26	do----	--	do-----	.002	1.81	.006	3.6	.96
27	do----	--	Quartz vein material with limonite from dump	.003	1.25	.15	2.8	.18
28	do----	--	do-----	.0003	.31	.061	.19	.31

Data for samples shown in figure 10, Mines and prospects in the New York Butte area--Continued

Sample			Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
Sample no.	Type	Length (ft)						
<u>Burgess mine area--Continued</u>								
29	Select	--	Altered, limonite-stained volcanic rocks from dump-----	N	0.064	0.12	0.065	0.11
30	do----	--	do-----	N	N	.001	N	.005
31	do----	--	Quartz vein material with limonite from dump	N	N	N	.0037	.0028
32	do----	--	Quartz vein material from dump-----	N	N	N	.0054	.0048
33	do----	--	Volcanic rocks from dump-----	N	N	N	N	.0044
<u>Unnamed prospect no. 43</u>								
34	do----	--	Limonite-stained hornfels with traces of calcite and inclusions of porphyritic rocks; from dump-----	N	N	.0006	.0034	.0079
<u>Far Ridge prospect</u>								
35	do----	--	Three-hundred pound stockpile of limonite- stained quartz vein material-----	.022	.030	.0008	.018	.0021

Burgess Mine Area

The Burgess mine (loc. 42, fig. 2) is located on the southeast flank of New York Butte. The mine is at the crest of the Inyo Range at elevations between 9,200 and 10,000 ft. Access is by a barely passable four-wheel-drive road from Swansea. The property was previously mapped and sampled by Close (1985, 1986).

Mining took place in the 1890's and early 1900's (McGirk and MacKevette, 1950, p. 21). In 1910, 46 tons of ore were shipped which yielded 22 oz gold and 11 oz silver (Close, 1985, p. 74). Sporadic small-scale development was done between 1918 and 1938, and ore milled in 1919, then known as the Iron Side mine, was valued at \$20 to \$40 per ton (Tucker, 1920, p. 280). In the 1930's, the mine was covered by 19 lode claims (Tucker and Sampson, 1938, p. 388). One claim was located in 1981, and the Burgess millsite and lode claims were located in 1983.

Underground workings included a 156-ft inclined shaft, a 700-ft crosscut adit, and 2,000 ft of drifts (Tucker, 1920, p. 280). There are 64 prospect pits, 12 incline shafts, 6 shafts, 12 trenches, and 10 adits in the mine area (Close 1986). Nearly all of the underground workings are caved. Many are on altered joints with thin quartz stringers and give no indication of mineralized structures. Most workings lie within the WSA but are excluded from the study area (fig. 10).

Gold and silver were mined from a quartz vein that occurs intermittently along a bedding plane fault that strikes N. 20° W. and dips 35° to 46° SW. The vein is iron stained and attains a maximum thickness of about 2.5 ft (McGirk and MacKevette, 1950, p. 10). A very poorly exposed zone of quartz veins along faults in limestone, shale, and quartzite trends northwest and dips 35° to 50° SW. (Close, 1986). The zone is 80 to 100 ft wide and is at least 3,800 ft long. Most of the individual faults cannot be traced for more than 100 ft on the surface.

Thirteen grab or select samples were taken from stockpiles and dumps at pits and shafts in the Burgess mine area (fig. 10). Four samples contained detectable gold. Nine samples contained between 0.016 and 8.5 oz/ton silver. Eleven samples contained between 0.0037 and 4.8 percent lead. The remainder of the analyses indicated no significant values.

Close (1986) concludes that the metals-bearing occurrences are numerous but scattered, poorly exposed, discontinuous, and diversely oriented. Stockpiles contain good metal values, but in most instances, nearby structures do not. Results of this reconnaissance support these findings. The remote location, lack of continuous structure, and sporadic metal content would make development unlikely without extensive additional subsurface exploration data.

Burgess Mine Area

The Burgess Mine (loc. 43, fig. 2) is located on the northeast flank of New York Butte. The mine is at the crest of the low ridge at elevations between 9,200 and 10,000 ft. Access is by a fairly good four-wheel-drive road from Jackson. The property was previously owned and sampled by Close (1955, 1956).

Mining took place in the 1890's and early 1900's (Hedrick and Mackay, 1920, p. 21). In 1910, no less than 100 men were employed which yielded 25 oz gold and 11 oz silver (Close, 1955, p. 14). Sporadic small-scale development was done between 1918 and 1935, and ore milled in 1919, then known as the Iron Star mine, was valued at \$20 to \$40 per ton (Lucker, 1920, p. 250). In the 1930's, the mine was covered by 15 tons of waste (Lucker and Swenson, 1938, p. 400). One claim was located in 1981, and the Burgess mine and other claims were located in 1982.

Underground workings included a 100-ft inclined shaft, a 700-ft crosscut adit, and 5,000 ft of drift (Lucker, 1920, p. 250). There are 64 prospect pits, 15 incline shafts, 8 adits, 15 crosscuts, and 10 adits in the mine area (Close, 1955). Nearly all of the underground workings are caved. Many are on alluvial fans with thin quartz stringers and give no indication of mineralized structures. Most workings lie within the WSA but are excluded from the study area (fig. 10).

Gold and silver were mined from a quartz vein that occurs intermittently along a bedding plane fault that strikes N. 20° W. and dips 35° to 45° SW. The vein is vein stained and attains a maximum thickness of about 2.5 ft (Close and Mackay, 1920, p. 10). A very poorly exposed zone of quartz veins along faults in limestone, shale, and quartzite trends northwest and dips 30° to 50° SW (Close, 1955). The zone is 50 to 100 ft wide and is at least 3,800 ft long. Most of the individual faults cannot be traced for more than 100 ft on the surface.

Thirteen grab or select samples were taken from stockpiles and dumps of pits and shafts in the Burgess mine area (fig. 10). Four samples contained detectable gold. Nine samples contained between 0.01% and 8.2% silver. Eleven samples contained between 0.003% and 4.8 percent lead. The remainder of the analyses indicated no significant values.

Close (1955) concludes that the metal-bearing occurrences are numerous but scattered, poorly exposed, discontinuous, and diversely oriented. Stockpiles contain good metal values, but in most instances, heavy structures do not. Results of this reconnaissance support these findings. The remote location, lack of continuous structure, and sporadic metal content would make development unlikely without extensive additional subsurface exploration data.

New York Butte Prospects

The zone of quartz veins in the Burgess mine area extends northwestward across the west flank of New York Butte and continues into quartz monzonite as it enters the study area about 1 mi northwest of the Burgess mine. Mineralized structures are exposed at the Macaroon prospect (loc. 40) and unnamed prospects 37, 38, and 39.

Three inaccessible shafts and thirteen shallow prospect pits and trenches were developed on scattered surface exposures of iron staining and quartz veins. Twelve samples were taken; all but one contained detectable gold (fig. 10). A select sample and a random chip sample from two prospect pits located about 1,000 ft apart at loc. 37 (fig. 10) contained 5.72 and 17.4 oz/ton silver, respectively. The higher value is from a sample that included a 0.1-ft-thick quartz vein. This structure is not well enough exposed to evaluate fully, but these samples are rich enough to warrant further investigation.

Million Dollar Baby Prospect

At the Million Dollar Baby prospect (loc. 41, fig. 2), two adits, 70 and 120 ft long, are situated about 600 ft apart in the bottom of a steep-sided drainage about 0.5 mi west of the Burgess mine. These adits lie just inside the eastern study area boundary (fig. 10). Access is by foot from the Burgess mine.

Several small diorite and aplite dikes trend east in quartz monzonite. Associated with these dikes are small shear zones with clay and narrow quartz veins within them. One quartz vein, which is exposed for 70 ft in the southern adit, contains visible pyrite and galena. The vein strikes north and dips 8° west. It pinches and swells between 0.1 and 1.0 ft in thickness. Four samples from this vein contained 1.02 to 3.85 oz/ton silver. They also contained 0.76 to 2.5 percent lead, and 0.12 to 5.5 percent zinc. Four samples from the northern adit contained no significant values.

Additional subsurface data would be needed to determine the extent of the veins and dikes and their relationship. The small size and irregular nature of the veins makes mineral development unlikely.

Quartz Veins in the Pat Keyes Trail Area

A system of quartz veins crops out in the study area northeast of the Reward mine in quartz monzonite, granodiorite, and diorite of the Hunter Mountain batholith. Most of the veins are discontinuous stringers along fractures, faults, and shear zones, but some crop out for considerable distances and attain thicknesses of several feet. Most of the veins have low-metal content, but locally they contain argentiferous galena in significant quantities and some copper, zinc, and gold. The veins are thickest and most abundant near the margins of the batholith where it intrudes metasedimentary rocks of the Keeler Canyon Formation.

Mines and prospects that relate to this vein system are shown on fig. 11, and descriptions are given in the appendix. Three properties, the International Recovery and Spanish Belt prospects, and an unnamed prospect, are described herein to illustrate the modes of occurrence of the veins.

The Spanish Belt prospect and the unnamed prospect 2,000 ft to the northwest both appear to lie on the same trend, which is herein referred to as the Spanish Belt trend. Both properties are on shear zones that align with each other, and both are mineralized similarly. Direct evidence for continuity of the structures was not found.

International Recovery Prospect

The International Recovery prospect (loc. 10, fig. 11) contains the largest system of quartz veins found within the study area. The prospect is about 0.8 mi north of the Reward mine and is partially within the study area. Access is by hiking 1,500 ft east on the Pat Keyes Trail from the trail head, and 500 ft south across country. Topography is steep; elevations range from 4,500 to 5,200 ft.

Mining activity probably began around the time of formation of the Russ mining district circa 1860. Since 1872, numerous mining claims have been located in the area, the most recent being the Onward Nos. 1-6 by Firestone Mining Industries in 1960 and the current claims by Missouri Mines, Inc. in 1982. No production is recorded. About 60 tons of material from an inclined shaft is stockpiled on the dump.

Quartz veins in shear zones in the Hunter Mountain batholith are explored by a 38-ft inclined shaft, two caved adits, one 25-ft open cut, two trenches and two prospect pits (fig. 12). Four major quartz veins strike from N. 60° W. to N. 50° E.; dips are generally less than 45° to the northeast or southwest. The veins have been folded and faulted. They contain stringers, blebs, and boxworks of limonite, pseudomorphs of pyrite, chalcopyrite, pyrite, galena, and calcite. They are 0.5 to 7.0 ft thick and are exposed on the surface for up to 970 ft.

Thirty-six samples were collected (fig. 12). Only four samples (Nos. 21-24), representing two small vein segments, had significant values, averaging 0.17 oz/ton gold, 2.4 oz/ton silver, and 1.3 percent copper. Additional mapping, sampling, and geophysical surveys would disclose if resources exist in these segments. The other veins appear to be barren at the surface.

Spanish Belt Trend

The Spanish Belt trend is defined by two mineral occurrences--the Spanish Belt prospect (loc. 15, fig. 11) and an unnamed prospect (loc. 14, fig. 11)--which are about 2,000 ft apart. The zone trends northwest for about 4,000 ft and consists of shear zones and quartz veins in diorite of the Hunter Mountain batholith. A steep canyon transects the

- 2 Valley View prospect
- 3 Unnamed prospect
- 4 Rolling Thunder No. 3 prospect
- 5 Peacock Nos. 1 and 2 prospect
- 6 Unnamed prospect
- 7 do
- 8 do
- 9 Frostbitten prospect
- 10 International Recovery prospect
- 11 Unnamed prospect
- 12 do
- 13 do
- 14 do
- 15 Spanish Belt prospect

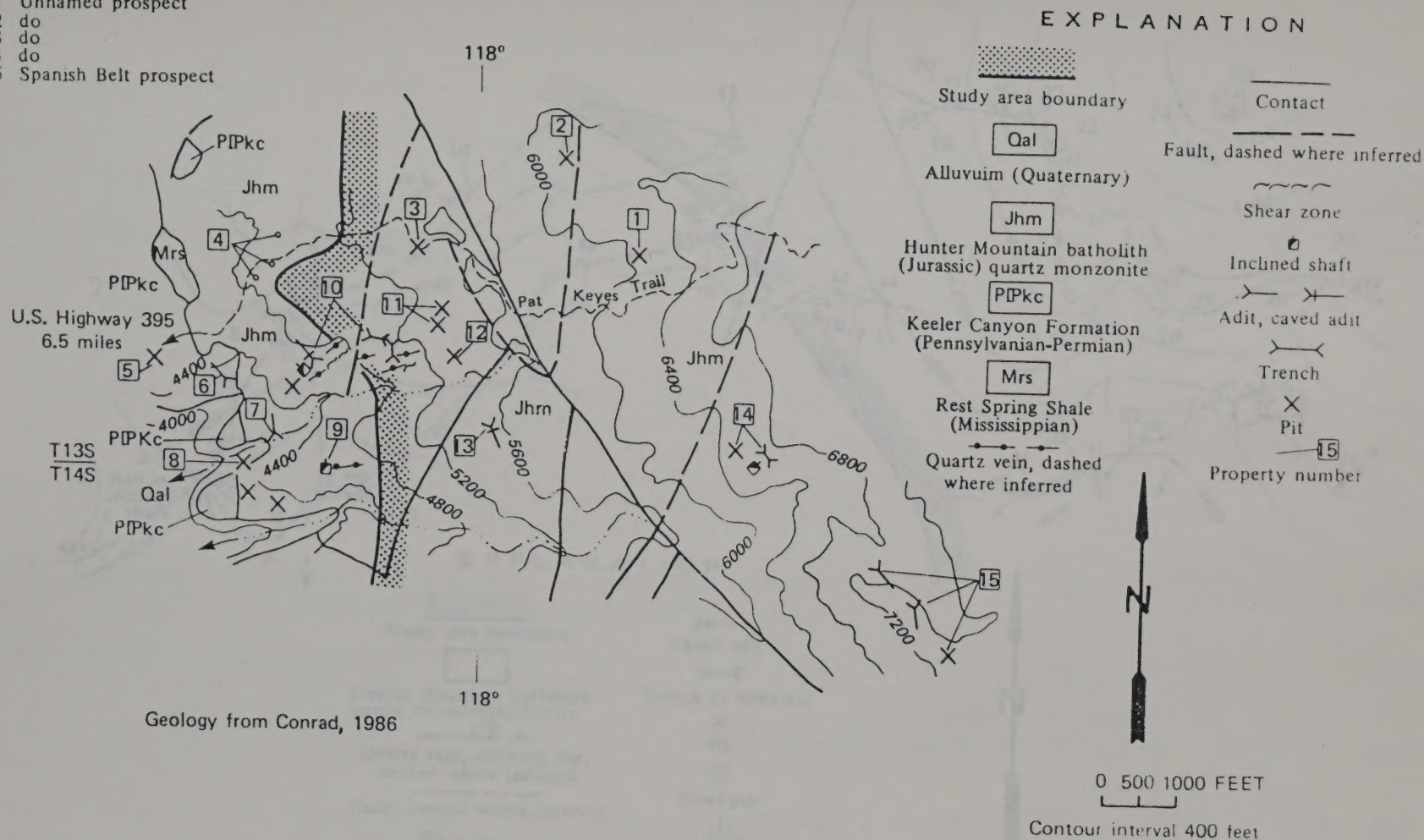


FIGURE 11.—Mines and prospects in the Pat Keyes Trail area

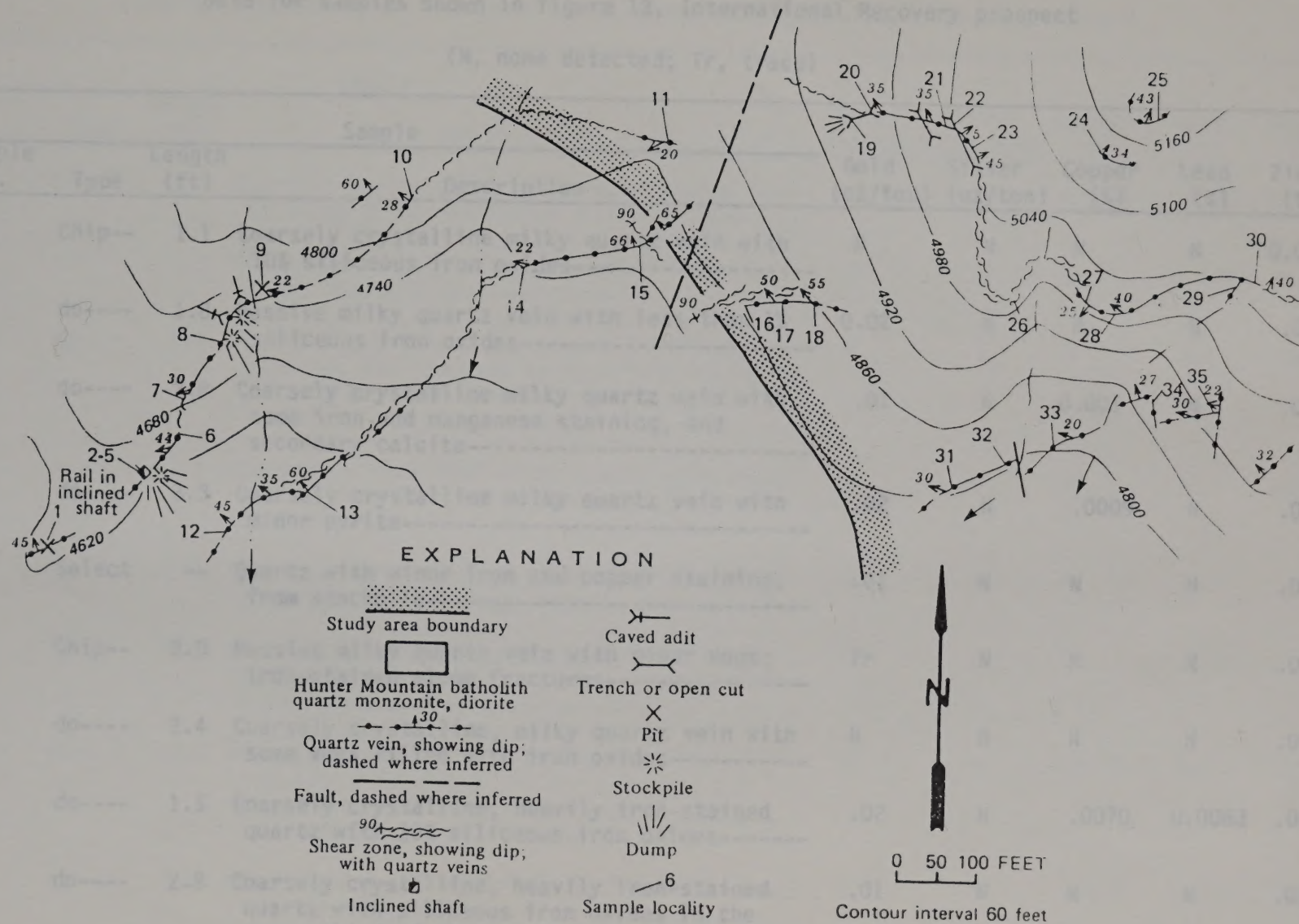


FIGURE 12.— International Recovery prospect

Data for samples shown in figure 12, International Recovery prospect

(N, none detected; Tr, trace)

Sample no.	Type	Length (ft)	Sample	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
			Description					
1	Chip--	1.1	Coarsely crystalline milky quartz vein with 10% siliceous iron oxides-----	N	N	N	N	0.0009
2	do----	1.8	Massive milky quartz vein with less than 1% siliceous iron oxides-----	0.02	N	N	N	.0018
3	do----	2.8	Coarsely crystalline milky quartz vein with some iron and manganese staining, and secondary calcite-----	.01	N	0.001	N	.0016
4	do----	3.3	Coarsely crystalline milky quartz vein with minor pyrite-----	.02	N	.0009	N	.0027
5	Select	--	Quartz with minor iron and copper staining; from stockpile-----	.01	N	N	N	.0010
6	Chip--	2.0	Massive milky quartz vein with minor vugs; iron-stained along fractures-----	Tr	N	N	N	.0009
7	do----	2.4	Coarsely crystalline, milky quartz vein with some vugs filled with iron oxides-----	N	N	N	N	.0016
8	do----	1.5	Coarsely crystalline, heavily iron-stained quartz with 20% siliceous iron oxides-----	.02	N	.0070	0.0083	.0036
9	do----	2.8	Coarsely crystalline, heavily iron-stained quartz with siliceous iron oxides in the upper third of the vein-----	.01	N	N	N	.0013

Data for samples shown in figure 12, International Recovery prospect--Continued

Sample no.	Sample		Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
	Type	Length (ft)						
10	Chip--	1.7	Coarsely crystalline, milky quartz with iron staining along fractures-----	N	N	0.0008	N	0.0014
11	do----	1.2	Milky quartz vein with silicified limonite along fractures-----	Tr	N	N	0.0033	N
12	do----	2.3	Highly fractured, milky quartz with iron staining and limonite along fractures, minor vugs filled with limonite, and limonite stringers and boxworks-----	N	N	N	N	.0014
13	do----	3.2	Coarsely crystalline milky quartz with minor quartz crystals in fractures; light iron staining-----	N	N	N	N	.0013
14	do----	1.9	Coarsely crystalline milky quartz with stringers of siliceous iron oxide-----	N	N	N	N	.0026
15	do----	1.1	Coarsely crystalline milky quartz with a siliceous iron-oxide veinlet; heavily iron-stained along fractures-----	N	N	N	.0021	N
16	do----	3.0	Coarsely crystalline milky quartz with limonite-filled vugs; minor chlorite and manganese oxide along fractures; heavily iron stained-----	N	N	.0008	N	.001
17	do----	2.0	Coarsely crystalline milky quartz with minor iron staining-----	N	N	.0022	.0093	.0050

Data for samples shown in figure 12, International Recovery prospect--Continued

Sample no.	Sample		Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
	Type	Description					
18	Chip--	1.0 Coarsely crystalline milky quartz with limonite and vugs filled with siliceous limonite boxworks-----	N	0.1	0.0027	0.0031	0.0025
19	Select	-- Quartz with pyrite, chalcopyrite, and secondary copper staining from dump-----	0.07	.1	.13	.014	.0059
20	Chip--	.8 Milky quartz with minor vugs and jasperoid with possible sericite-----	.02	N	.016	.020	.0027
21	do----	1.3 Milky quartz with vugs filled with limonite; heavily iron stained-----	.02	.3	.19	.038	.0073
22	do----	2.2 Coarsely crystalline quartz with limonite, chrysocolla, and chalcopyrite altering to goethite-----	.30	1.3	.49	.089	.016
23	do----	1.0 Milky quartz with iron and copper staining along fractures-----	.34	1.7	4.3	.023	.018
24	do----	.5 Crystalline quartz with quartz crystal intergrowths, chalcopyrite, limonite, stringers, and possible pyrite-----	.04	6.4	.17	.31	.0006
25	do----	.4 Milky, crystalline quartz with pyrite and limonite stringers and blebs-----	N	N	.001	.0047	.001
26	do----	.5 Crystalline quartz vein with blebs of chalcopyrite and minor limonite-filled vugs and blebs-----	.06	.1	.15	.0031	.0008

Data for samples shown in figure 12, International Recovery prospect--Continued

Sample no.	Sample		Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
	Type	Description					
27	Chip--	4.4 Quartz with quartz crystal intergrowths and silicified monzonite; iron-stained along fractures, minor limonite-filled vugs with quartz crystals-----	N	N	N	0.0023	N
28	do----	2.2 Crystalline quartz vein with minor limonite blebs and iron staining-----	N	N	N	.0018	N
29	do----	1.1 Massive quartz with minor iron staining-----	Tr	N	N	.0011	N
30	do----	1.7 Massive quartz with minor iron staining, goethite, limonite blebs, and copper staining-----	N	N	N	.0012	N
31	do----	.8 Coarsely crystalline massive quartz with band of silicified iron oxides along upper contact; minor quartz-filled vugs and limonite boxworks-----	N	N	0.0011	.0017	0.0021
32	do----	1.3 Coarsely crystalline, heavily iron-stained, milky quartz with some quartz crystal intergrowths, oxidized pyrite cubes, and vugs with limonite and quartz crystals-----	N	N	N	N	.0017
33	do----	.9 Coarsely crystalline, milky quartz with vugs filled with limonite, silicified limonite, and quartz crystals-----	N	N	N	.0019	.0012

Data for samples shown in figure 12, International Recovery prospect--Continued

Sample no.	Type	Length (ft)	Sample	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
			Description					
34	Chip--	7.0	Coarsely crystalline milky quartz with quartz crystal intergrowths up to 0.2 ft and minor vugs-----	N	N	N	N	N
35	do----	4.0	Massive, vuggy, milky quartz with quartz crystals; upper third of vein is heavily iron and manganese stained-----	N	N	N	N	0.0018
36	do----	2.8	Massive milky quartz with quartz crystal intergrowths-----	N	N	N	N	.001

zone between the two prospects, and it is not known if the zone is continuous across the canyon. Terrain is rugged; elevations range from 6,400 to 7,200 ft. The zone is entirely within the study area.

Inyo County claim records indicate the Spanish Belt claim was located in 1883 by Joseph Alvarez for lead and silver. No production is known. About 90 tons of vein material were removed from one adit.

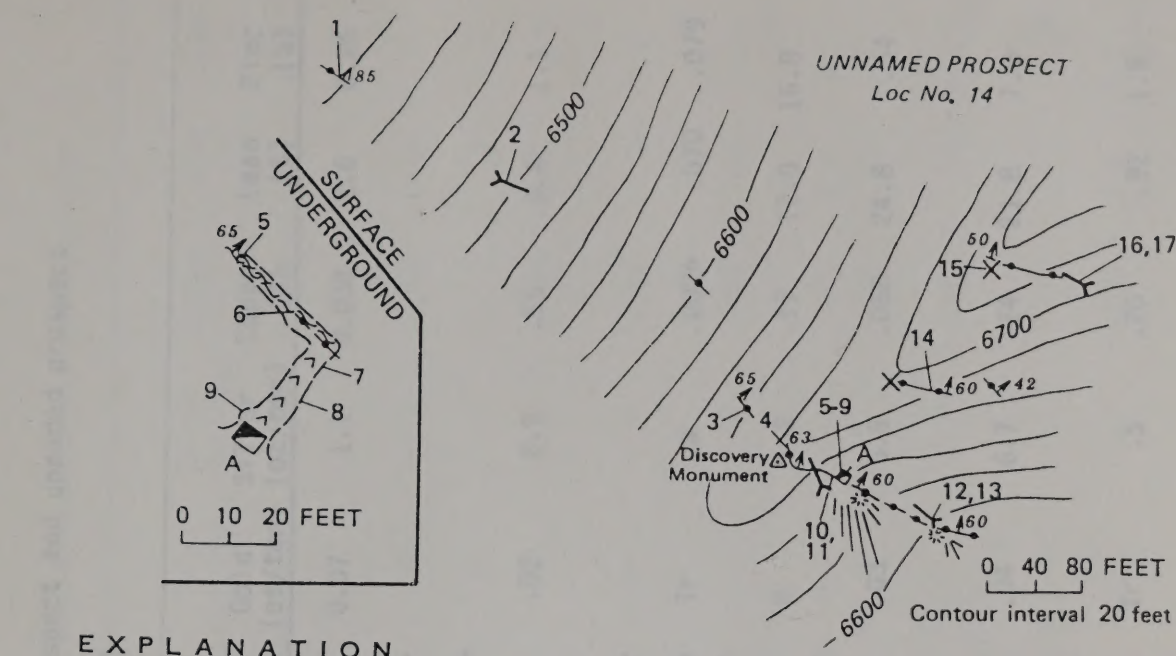
At the Spanish Belt prospect, two mineralized shear zones in diorite are explored by two adits, 43 and 55 ft long, and two open cuts, 10 and 17 ft long (fig. 13). The shear zones strike N. 37° W. and N. 88° W. and dip steeply southwest. They range from 0.6 to 1.8 ft thick and are exposed for 110 and 120 ft. They may extend 850 ft between workings, but no direct evidence of this continuity was observed. Mineralized portions of the shear zone contain argentiferous galena, quartz, limonite, gouge, secondary copper minerals, and silicified, brecciated country rock.

About 500 ft to the southeast, quartz vein float was found on the south side of an east-trending felsic dike. The vein contained galena, chalcopyrite, chrysocolla, malachite, limonite, hematite, and siderite. It trends north, is about 0.2 to 0.3 ft thick, and was traced for 50 ft.

The unnamed prospect (loc. 14, fig. 11) is 2,000 ft northwest of the Spanish Belt. Rock monuments mark the claim boundaries and the discovery, but no location notice was found. A rock shelter and milling site of unknown age or origin was found near the discovery monument. No production is known. About 130 tons of sheared rock and vein material were removed from the incline shaft and 20-ft adit.

A series of parallel northwest-trending shear zones in quartz monzonite is explored by four adits, 8 to 20 ft long, one 35-ft inclined shaft with a 25-ft drift, and two prospect pits (fig. 13). The three main shear zones strike N. 50° to 70° W. and dip 50° to 80° NE. They are 0.6 to 3.5 ft thick and are 45, 90, and 155 ft long. One shear zone was traced discontinuously by workings and vein float 560 ft northwest along the alignment. About 500 ft further to the northwest, a northeast-trending fault truncates the structure. The shear zones are partially replaced by vein quartz with associated argentiferous galena, limonitic jasper boxworks, hemimorphite, calcite, secondary copper minerals, limonite, hematite, and goethite.

Seventeen chip samples were collected from the unnamed prospect and eleven from the Spanish Belt prospect (fig. 13). Samples from the unnamed prospect are richer than those from the Spanish Belt, averaging 0.01 oz/ton gold, 2.3 oz/ton silver, 0.11 percent copper, 6.9 percent lead, and 2.7 percent zinc. Spanish Belt samples average 0.02 oz/ton gold, 0.46 oz/ton silver, 0.03 percent copper, 0.67 percent lead, and



EXPLANATION

Hunter Mountain batholith (Jurassic-Cretaceous), quartz monzonite, diorite

Vein, showing dip;
dashed where approximate

Fault

Shear zone, showing dip;
dashed where inferred

Inclined shaft

Adit

Trench or cut

Pit

Inclined workings,
chevrons point down

Stockpile

Dump

6
Sample locality

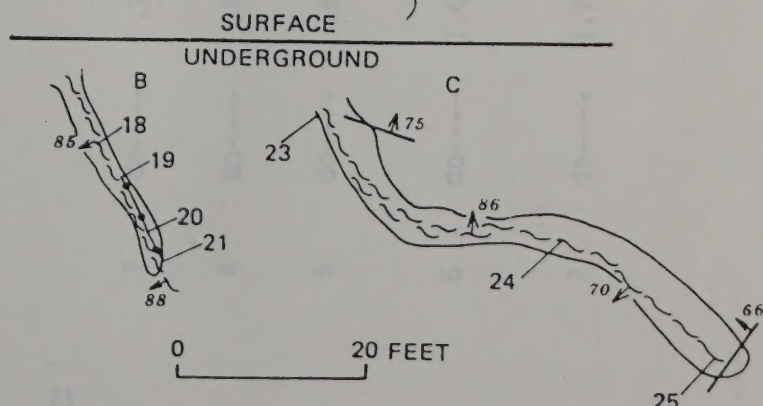
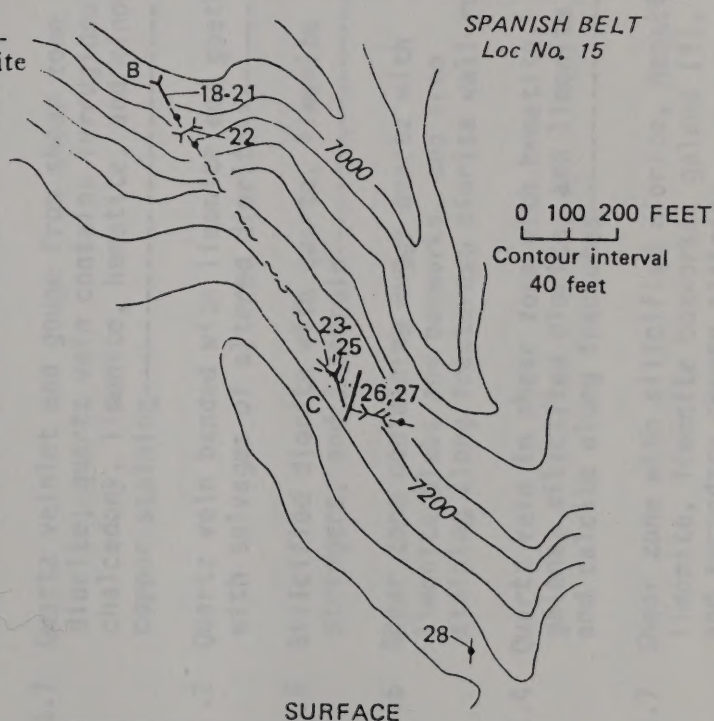


FIGURE 13.—Spanish Belt prospect and unnamed prospect

Data for samples shown in figure 13, Spanish Belt prospect and unnamed prospect

(N, none detected; Tr, trace)

Sample			Gold	Silver	Copper	Lead	Zinc	
Sample no.	Type	Length (ft)	Description	(oz/ton)	(oz/ton)	(%)	(%)	(%)
1	Chip	0.5	Quartz vein and silicified diorite from shear zone. The quartz contains a band of jasperoid and iron staining along fractures. The altered diorite contains weathered limonite blebs-----	0.07	1.1	0.038	2.6	0.26
2	do----	1.7	Quartz veinlet and gouge from shear zone in diorite; quartz vein contains ferruginous chalcedony, limonite, hematite, and minor copper staining-----	.02	2.9	.15	8.4	1.1
3	do----	.2	Quartz vein banded with limonite and goethite with selvages of altered diorite-----	Tr	N	.0026	.070	.079
4	do----	.6	Silicified diorite with quartz, limonite stringers, and jasperoid-----	N	1.9	.17	12.0	16.8
5	do----	.6	Shear zone containing vuggy quartz with limonite blebs and boxworks, and iron staining along fractures; diorite wall rock	.03	5.5	.068	24.8	.54
6	do----	1.4	Quartz vein in shear zone with hematite, galena, silicified diorite, and limonite and calcite along fractures-----	.04	6.7	.24	21.8	7.0
7	do----	1.7	Shear zone with silicified diorite, hematite, limonite, limonite boxworks, galena (?), and secondary copper staining-----	Tr	.5	.26	.92	1.8

Data for samples shown in figure 13, Spanish Belt prospect and unnamed prospect--Continued

Sample no.	Sample		Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
	Type	Description					
8	Chip--	1.0 Quartz vein in shear zone with limonite bands, hematite, and limonite boxworks; in altered diorite-----	0.01	1.7	0.050	3.4	0.26
9	do----	2.1 Quartz vein in silicified shear zone with limonite, hematite, limonite boxworks, pods of galena, and jasperoid-----	.01	1.2	.082	3.0	1.5
10	do----	.5 Vuggy quartz with limonite, hematite, and limonitic boxworks-----	.03	3.2	.096	5.5	.79
11	do---	.6 Shear zone containing gouge, altered diorite, and a limonite/hematite band-----	Tr	.1	.031	.76	1.4
12	do---	2.3 Shear zone with limonite, hematite, gouge, minor quartz and talc; in altered diorite---	Tr	.1	.027	.40	.73
13	do---	2.2 Vuggy quartz vein in sheared diorite contains limonite, hematite, limonitic boxworks, and gouge-----	Tr	1.1	.068	5.1	3.8
14	do---	.3 Quartz vein in sheared silicified diorite; quartz is brecciated, vuggy, and iron stained along fractures; quartz contains hematite, limonite, jasperoid, and possible hemimorphite	N	2.6	.056	.69	1.1
15	do---	.35 Vuggy quartz with limonitic boxworks and possible galena, iron and copper staining along fractures-----	.04	1.3	.080	1.3	4.2

Data for samples shown in figure 13, Spanish Belt prospect and unnamed prospect--Continued

Sample no.	Sample		Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
	Type	Description					
16	Chip--	0.8 Vuggy quartz vein with galena, limonite blebs, and iron and copper staining along fractures	Tr	9.8	0.19	25.9	3.7
17	do---	.4 Massive milky quartz with hematite, limonite blebs and stringers, and minor vugs-----	Tr	3.7	.098	3.7	3.2
18	do---	1.5 Shear zone with clay gouge, limonite-stained gouge, and minor quartz; in altered diorite	.02	.9	.082	1.6	1.5
19	do---	.25 Brecciated quartz and calcite vein with some limonite along fractures-----	N	.1	.0024	.029	.041
20	do---	.3 Quartz and calcite vein with minor limonite blebs, specular hematite, and arsenopyrite (?)	.04	.2	.0088	.078	.021
21	do---	1.1 Shear zone with some quartz, limonite, and gouge; in altered diorite-----	Tr	.2	.017	.18	1.1
22	do---	1.0 Shear zone containing iron oxides and a quartz veinlet; in highly fractured diorite	.04	1.4	.028	.85	1.2
23	do---	1.6 Shear zone with some limonite along fractures; in altered diorite-----	N	N	.004	.0053	.02
24	do---	1.8 Shear zone with white clay gouge and limonite along fractures; diorite wall rock-----	N	.1	.0054	.022	.015
25	do---	.6 Iron-stained shear zone in diorite-----	.08	.7	.11	.18	.06

Data for samples shown in figure 13, Spanish Belt prospect and unnamed prospect--Continued

Sample no.	Sample		Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
	Type	Description					
26	Chip-	1.2 Shear zone with quartz veinlets, galena, limonite bands, gouge, silicified diorite, and minor copper staining and iron-oxide boxworks; in diorite-----	0.01	0.5	0.16	2.2	0.83
27	Select	-- High-grade sample of galena in quartz with iron-oxide boxworks, limonite, and secondary copper minerals-----	.01	41.1	.25	25.1	.34
28	do----	-- Milky quartz vein with galena, chalcopyrite, limonite, hematite, calcite, and copper staining-----	.01	5.2	2.6	5.8	.098

0.62 percent zinc. Individual veins and shears are too thin and discontinuous to mine economically, but detailed geologic mapping, sampling, and geophysical and geochemical surveys along the entire trend might yield evidence for continuity of the structure and possible resources.

Other Silver-Lead-Zinc Occurrences

San Pablo Prospect

The San Pablo prospect (loc. 27, fig. 2) is on a ridge in the northern part of the study area, about 9,000 ft N. 70° W. from Keynot Peak. It is situated in steep terrain at an elevation of 9,000 ft. Access is via a foot trail from Union Wash. The property was claimed in 1930 by J. Earl Church, but the workings might be much older. No production is recorded, and there is no evidence that ore was shipped.

Three adits, a cut, and a trench explore a mineralized shear zone that is 200 ft long but may extend another 165 ft southward to a pit on the ridge top (fig. 14). The shear zone is limonitic and argillic with some clay gouge and minor silicification. Discontinuous quartz veins and stringers, 0.1 to 1.0 ft thick and as long as 50 ft, occur along the shear. The veins are dark brown, vuggy, drusy quartz with pockets of cellular limonite, galena, and secondary copper minerals. The section of the vein that is explored by workings on the north slope of the ridge is 200 ft long and averages 1.8 ft thick. A similar shear with a 1-inch-thick galena-bearing quartz vein is exposed in a cut near the ridge top and is probably an extension of the principal shear zone that is covered by soil. If so, the structure would have a total length of at least 365 ft.

Country rock is weakly metamorphosed, interbedded siltstone, shale, limestone, and quartzite of the Keeler Canyon Formation. Rocks are deformed by shearing and gentle folding.

Six chip samples and two select samples were collected (fig. 14). The chip samples have a weighted average of 5.84 oz/ton silver, 8.52 percent lead, and 1.03 percent zinc. All samples contain anomalous barium ranging from 0.1 to 0.84 percent.

The structure probably lacks the tonnage to be minable. Additional exploration in the form of more detailed mapping and sampling, geophysical surveys, and drilling would disclose if resources are present.

Pennsylvania Mine

The Pennsylvania mine (loc. 61, fig. 2) is 1.4 mi north of Swansea, about 0.2 mi south of the southern tip of the study area. It lies in gently rolling terrain at an elevation of 4,650 to 4,850 ft. The mine is accessible by an unimproved road from Swansea.

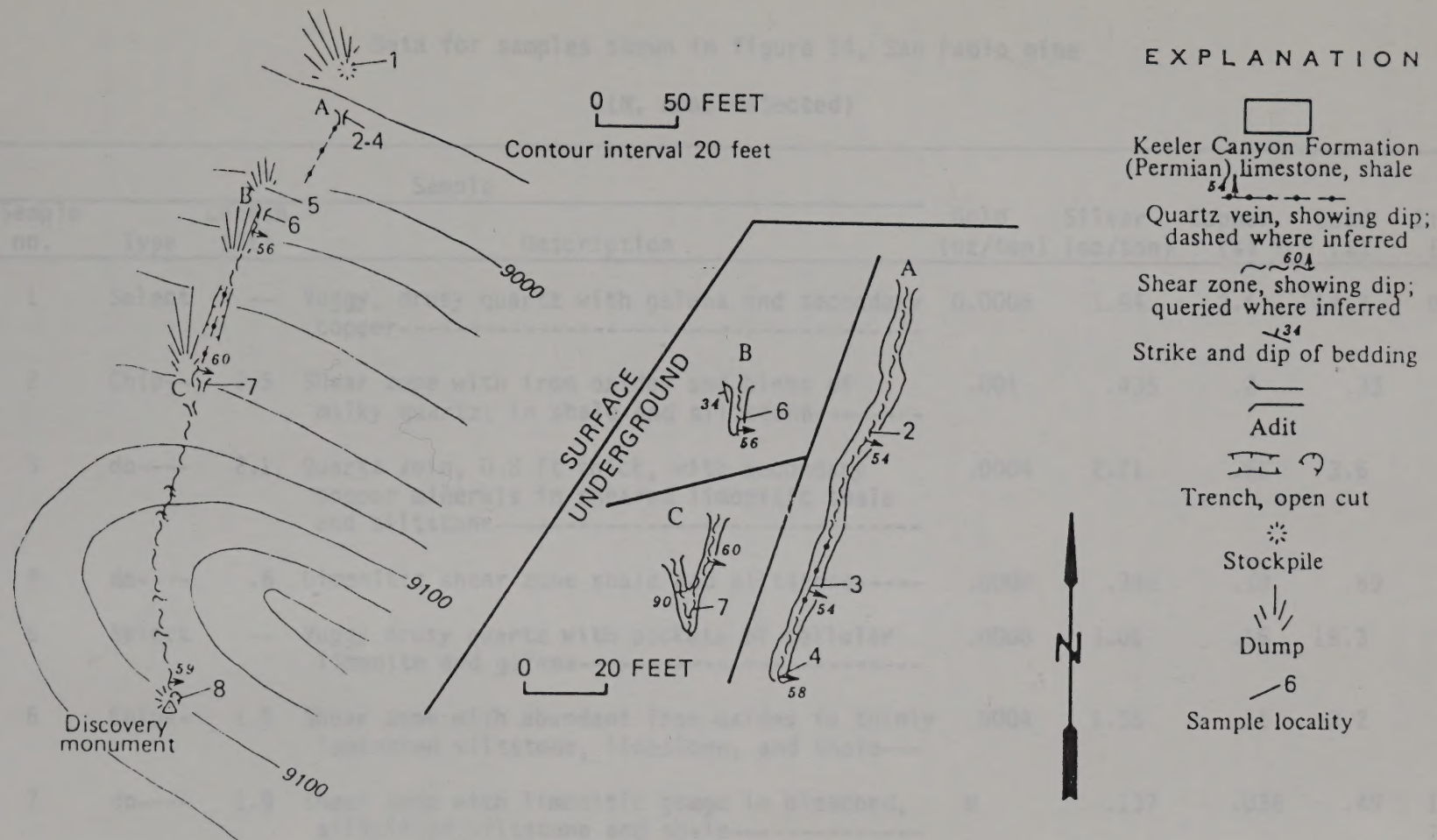


FIGURE 14.—San Pablo prospect

Data for samples shown in figure 14, San Pablo mine

(N, none detected)

Sample no.	Sample		Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
	Type	Length (ft)						
1	Select	--	Vuggy, drusy quartz with galena and secondary copper-----	0.0006	1.94	2.6	14.2	0.55
2	Chip--	2.5	Shear zone with iron oxides and blebs of milky quartz; in shale and siltstone-----	.001	.435	.2	.33	.23
3	do----	2.1	Quartz vein, 0.8 ft thick, with secondary copper minerals in sheared limonitic shale and siltstone-----	.0004	2.71	.53	3.6	.19
4	do----	.6	Limonitic shear zone shale and siltstone-----	.0008	.342	.18	.69	.37
5	Select	--	Vuggy drusy quartz with pockets of cellular limonite and galena-----	.0008	3.06	.16	18.3	.23
6	Chip--	1.9	Shear zone with abundant iron oxides in thinly laminated siltstone, limestone, and shale---	.0004	1.36	.11	3.2	.22
7	do----	1.9	Shear zone with limonitic gouge in bleached, silicified siltstone and shale-----	N	.137	.038	.49	1.2
8	do----	5.0	Sheared shale and siltstone containing disseminated cerussite and a 0.1- to 0.2-ft thick quartz vein with galena-----	.0067	14.4	.033	20.7	2.1

The original five claims of the Pennsylvania group were located in 1917. Fourteen more claims, the Queen of the Mountain group, were located between 1937 and 1942, encircling the original block. Production is recorded for nine years between 1918 and 1969. A total of 252 tons of ore yielded 5,584 oz silver, 86,473 lb lead, and some copper, zinc, and gold.

The deposit consists of two discontinuous silicified shear zones that trend northwest and dip 46° to 90° SW. (fig. 15). The shear zones pinch and swell between 1 and 6 ft in thickness. The northern shear is 300 ft long and averages 1.7 ft thick; the southern shear is 1,000 ft long and averages 2.5 ft thick. The alignment of the wash between the two shears and parallel to them suggests a possible third structure. Veins in the shear zones consist chiefly of lead and zinc carbonates, galena, calcite, and limonitic boxworks. Silicification of wall rocks produced minor amounts of jasperoid and chert. Country rock is limestone, arenaceous limestone, and siltstone of the Keeler Canyon Formation.

Workings consist of 14 inclined and vertical shafts, the deepest of which is 42 ft, 1 partly caved adit, 9 prospect pits, and 5 trenches scattered over an area about 0.3 mi long and 0.2 mi wide.

Twenty-five samples were collected (fig. 15). Samples from the northern structure averaged 1.1 oz/ton silver, 4.2 percent lead, and 4.2 percent zinc. Samples from the southern structure average 3.5 oz/ton silver, 5.6 percent lead, and 4.8 percent zinc. Because mineralization is discontinuous and spotty and samples tend to be from high-grade pockets, a resource estimate is not warranted. The data suggest that resources are possible, however. More detailed mapping, both on the surface and underground, augmented by geophysical and geochemical surveys, and possibly drilling would disclose if resources are present. Subsurface exploration along the northwest-trending wash could disclose a third structure.

Flagstaff Mine

The Flagstaff mine (loc. 64, fig. 2) is near the southern end of the study area about 300 to 900 ft outside of the boundary. It lies at an elevation of 5,200 to 5,350 ft in moderately rugged terrain. Access is by a poor four-wheel-drive road from Swansea.

Burchard (1884, p. 161) provides the first passing reference to the Flagstaff mine. In 1902, four veins were being mined for silver and lead, and the ore was milled in a steam-powered arrastra. The mine was then owned by F. P. Meysan of Lone Pine (California State Mining Bureau, 1902). The property was last claimed in 1974 by Diane Gibson and Robert Picard of Lone Pine but has been idle for a long time. USBM records indicate the Flagstaff mine yielded 319 oz silver in 1889 and 135 oz silver in 1891. The mine also yielded 2.66 oz gold during these years. No other production is known.

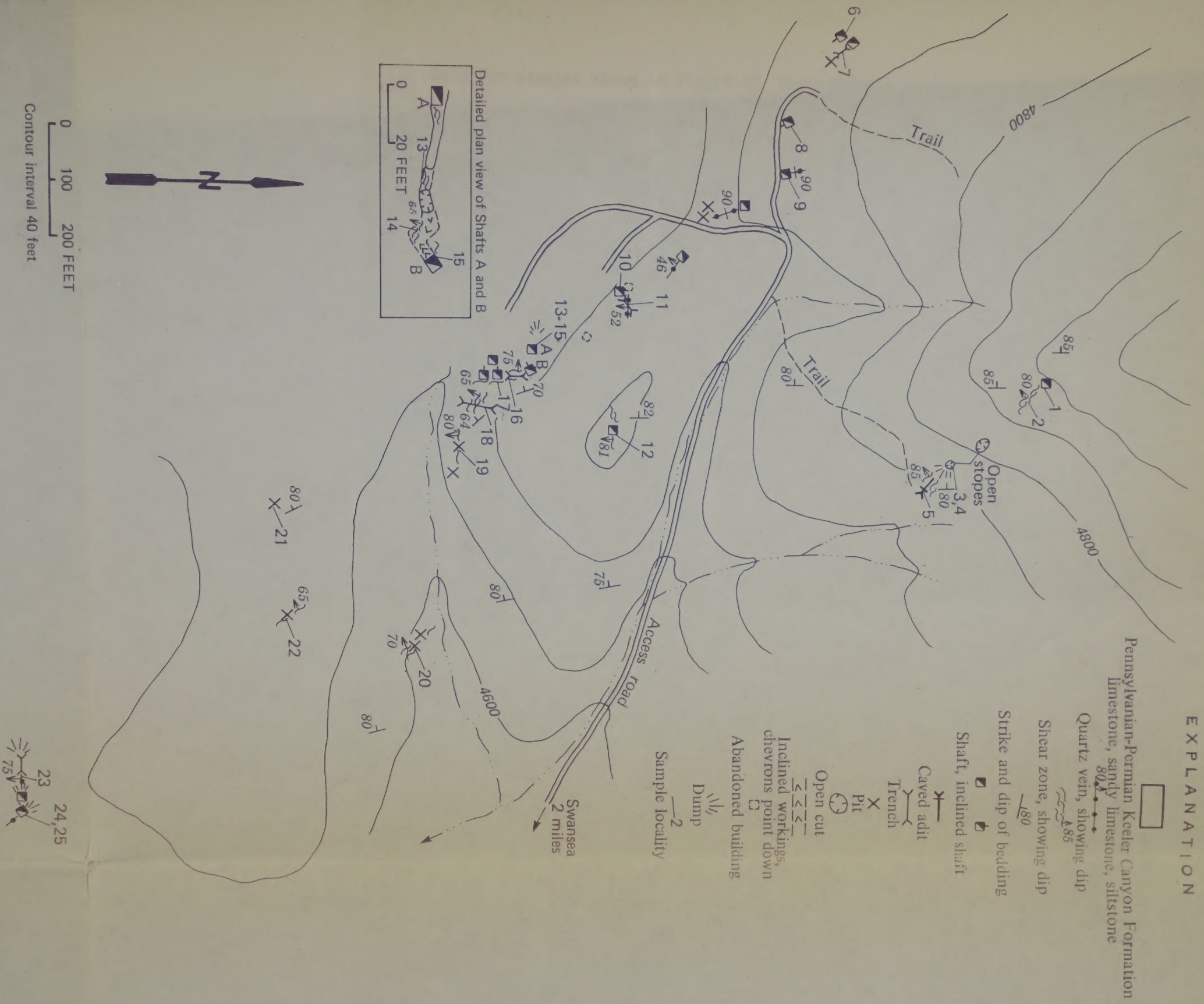


FIGURE 15.—Pennsylvania mine

Data for samples shown in figure 15, Pennyslvania mine

(N, none detected; Tr, trace)

Sample					Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
Sample no.	Type	Length (ft)	Description						
1	Chip--	2.1	Shear zone with galena and sphalerite-----		N	0.9	0.036	1.7	6.7
2	Grab--	--	Silicified limestone with galena and sphalerite from dump-----		N	3.8	.086	9.0	4.1
3	Chip--	1.0	Silicified shear zone-----		N	3.4	.027	17.1	6.3
4	Grab--	--	Silicified limestone with secondary lead and zinc minerals; from stockpile-----		N	6.7	.029	13.0	12.4
5	Chip--	2.0	Silicified shear zone-----		N	.2	.007	.35	.52
6	do----	.9	Limonitic zone with secondary lead and zinc minerals-----		N	3.2	.06	3.9	8.4
7	do----	3.5	do-----		N	2.3	.088	1.94	7.8
8	do----	1.5	do-----		N	5.5	.055	10.6	11.4
9	do----	1.6	do-----		N	.5	.079	1.05	8.4
10	do----	1.5	Limonitic silicified zone with galena-----		N	4.8	.033	11.0	2.82
11	do----	2.2	Shear zone with galena-----		N	1.8	.013	2.35	4.5
12	do----	1.6	do-----		Tr	.3	.005	.51	4.4

Data for samples shown in figure 15, Pennsylvania mine--Continued

Sample no.	Sample		Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
	Type	Length (ft)						
13	Chip--	3.2	Shear zone with quartz and secondary lead and zinc minerals-----	N	4.3	0.028	6.3	4.7
14	do----	1.9	Silicified shear zone-----	N	2.4	.099	2.76	9.2
15	do----	2.3	Shear zone with jasperoid-----	N	5.0	.036	4.8	5.8
16	do----	3.4	Silicified shear zone-----	N	11.7	.041	20.6	.72
17	do----	2.3	do-----	N	1.4	.043	2.12	3.2
18	do----	6.0	do-----	N	1.0	.05	2.56	3.0
19	do----	2.6	Limonitic shear zone-----	N	1.8	.021	3.0	1.9
20	do----	1.3	do-----	N	2.1	.066	3.7	9.7
21	do----	2.6	do-----	N	N	.003	.003	.009
22	do----	1.6	do-----	N	.2	.013	.074	.009
23	do----	.8	Shear zone with galena-----	.01	3.5	.002	.74	.24
24	do----	1.3	do-----	N	1.7	.004	3.8	5.3
25	do----	1.0	Across calcite vein-----	N	.1	.001	.039	.034

Workings include seven adits with drifts, winzes, and stopes totaling more than 600 ft. There are also a 90-ft shaft, an 80-ft incline shaft, 4 other shafts, and 14 prospect pits, cuts, and trenches (fig. 16).

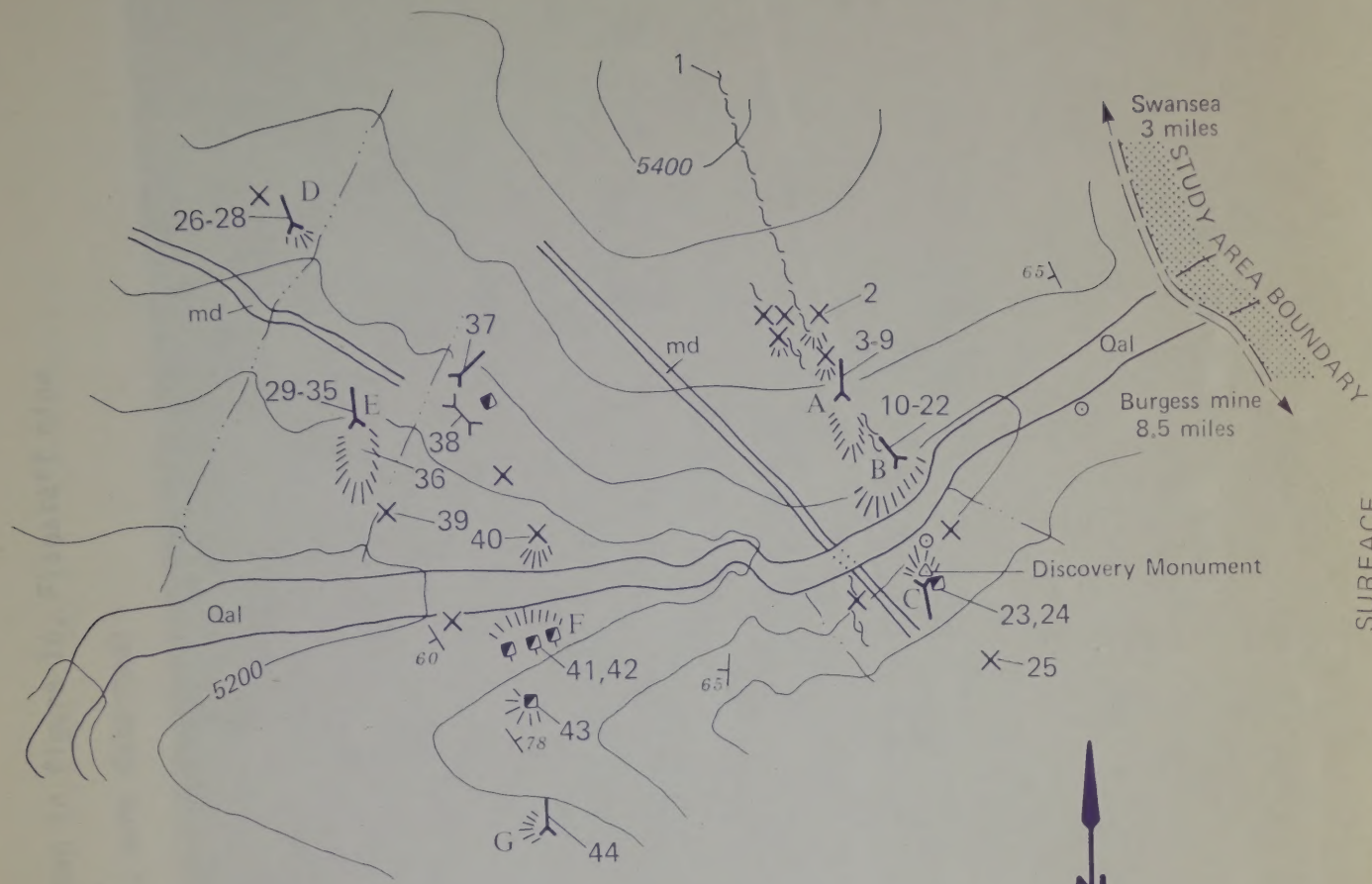
The Flagstaff mine develops a series of shear zones with quartz veins in phyllite, argillite, siltstone, and quartzite of the Permian Lone Pine Formation (fig. 16). The sediments are cut by northwest-trending mafic to intermediate dikes of Tertiary age which dip southwest and are as thick as 10 ft.

The principal structure in the eastern group of workings north of the sandy wash is a shear zone with quartz veins and stringers which locally contain argentiferous galena and chalcopryite. The zone was traced for 450 ft on the surface. It strikes N. 15° W. and dips 40° to 60° NE. In the adit at location B, the zone was traced underground for 125 ft along strike and 90 ft down dip; it averages 0.8 ft thick here. In the adit at location A, the zone was traced underground for 80 ft along strike and averages 0.7 ft thick. The shear zone consists of brecciated phyllite and siltstone with bands of iron oxide and clay and veins and stringers of quartz. A 3-ft-thick zone of jasperoid marks the footwall of the shear. Workings explore minor shears south of the wash, but the major zone does not appear to extend across the wash.

The western group of workings investigate several structures. The adit at location E follows an anastomosing shear zone with argillic, limonitic bands, quartz-calcite stringers as thick as 0.1 ft and blebs of pyrite. This zone trends N. 15° W. and was traced for 140 ft underground. An incline at location F exposes a dolomite-quartz vein 90 ft down dip along a bedding plane shear in siltstone. The vein contains blebs of tetrahedrite (?), malachite, sphalerite, chalcopryite, and pyrite; total sulfides are less than 1 percent. The vein is 0.2 to 0.4 ft thick. At location G, a dolomite-quartz vein with jasperoid, limonite, siderite, and calcite trends north for 35 ft in weakly silicified siltstone. The vein is as thick as 0.5 ft. No sulfides were observed. The adit at location D follows a series of dikes in argillite and siltstone. Some minor silicification and thin quartz veinlets follow contacts, but the zone is apparently not mineralized.

Sample sites are shown on figure 16, and data are in the accompanying table. Silver, lead, and zinc are the principal metals. The eastern structure has the most consistently high values, although the grade is still quite variable. This structure is inferred to contain about 3,700 tons averaging 3.37 oz/ton silver, 1.36 percent lead, and 2.01 percent zinc. The vein is only about 1 ft thick, however, which is too thin to mine. Some high values occur in the western workings, but their distribution is very spotty.

The silver values present might suggest further exploration, but there is no evidence that a large ore body is present. This type of mineralization in the Lone Pine and Keeler Canyon Formations is usually restricted to thin stringers and lenses along shear zones and faults.



EXPLANATION

- | | |
|---|--|
| Qal | Shaft inclined shaft |
| md | Adit |
| Lone Pine Formation, (Permian) phyllite, siltstone, quartzite | Trench |
| Quartz vein, showing dip; dashed where approximate | Head of winze |
| Contact, showing dip; dashed where approximate | Foot of winze |
| Shear zone, showing dip | Inclined workings, chevrons point down |
| Strike and dip of bedding | Claim marker |
| | Dump |
| | Sample locality |

0 50 100 FEET
Contour interval 40 feet

SURFACE
UNDERGROUND

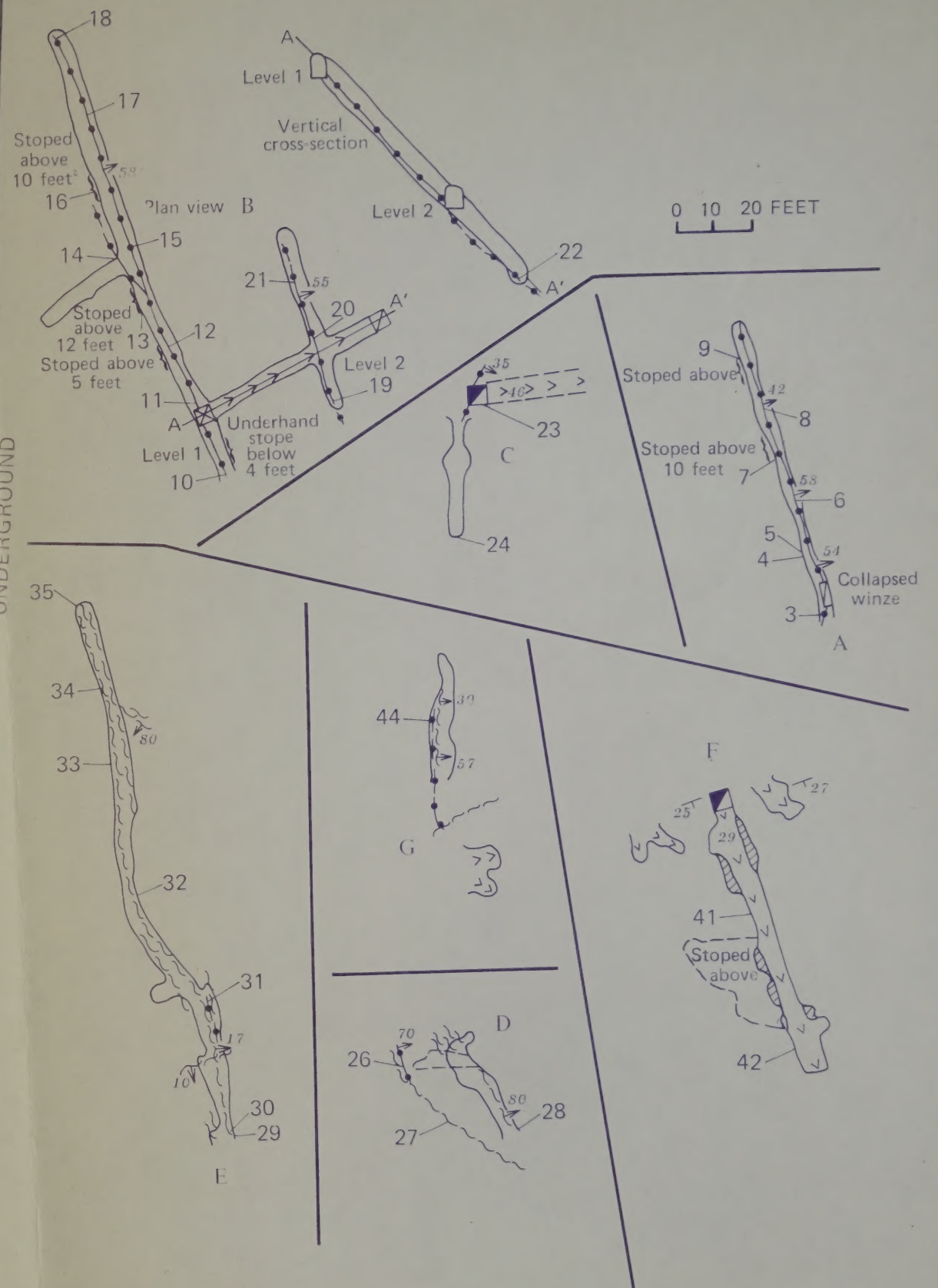


FIGURE 16.--Flagstaff mine

Data for samples shown in figure 16, Flagstaff mine

(N, none detected)

Sample					Gold	Silver	Copper	Lead	Zinc
Sample no.	Type	Length (ft)	Description		(oz/ton)	(oz/ton)	(%)	(%)	(%)
1	Chip--	5.0	Banded limy shale, chert, and chert breccia with abundant limonite along contact between shale and quartzite-----	N	0.05	N	0.0280	0.038	
2	do----	1.8	Sheared phyllite with quartz stringers less than 0.1 ft thick-----	0.0005	.33	0.13	.17	.30	
3	do----	1.0	Siliceous shear with abundant limonite and hematite and 0.02-ft-thick quartz stringers.	.012	3.0	.093	1.3	4.3	
4	do----	.5	Limonitic shear zone in siltstone-----	.004	3.5	.056	.76	1.4	
5	do----	3.0	Jasperoid zone in footwall of shear-----	N	1.6	.021	.56	.62	
6	do----	.6	Limonitic shear zone in siltstone-----	.013	14.8	.12	4.6	1.1	
7	do----	.9	Shear zone in siltstone including a 0.4-ft-thick quartz vein with galena and chrysocolla and a 0.25-ft-thick band of jasper and hematitic quartz-----	.001	5.3	.075	3.4	.92	
8	do----	.8	Silicified shear zone in siltstone with quartz blebs up to 0.2 ft thick and a band of jasperoid 0.13 ft thick-----	.001	1.0	.04	.39	2.0	
9	do----	.6	Shear zone in siltstone-----	.003	3.0	.026	.77	.95	

Data for samples shown in figure 16, Flagstaff mine--Continued

Sample					Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
Sample no.	Type	Length (ft)	Description						
10	Chip--	0.6	Shear zone with 0.2-ft-thick hematite band; in siltstone-----		0.009	4.4	0.06	1.5	1.7
11	do----	1.1	Shear zone with bands of jasperoid, hematite, and quartz up to 0.2 ft thick; in siltstone.		.041	6.9	.088	1.8	3.5
12	do----	.8	Siliceous shear zone in shale with bands of iron oxide-----		.002	3.4	.082	.68	2.0
13	do----	1.2	Shear zone in siltstone-----		.017	3.4	.063	1.7	.7
14	do----	.7	Limonitic shear zone with 0.2-ft-thick quartz stringer; in siltstone-----		.006	21.3	.066	3.6	1.8
15	do----	.8	Limonitic shear zone with quartz stringers; in siltstone-----		.004	4.7	.15	3.6	13.4
16	do----	1.2	Brecciated siliceous siltstone and shale with bands of iron oxide-----		.0003	.8	.023	.38	3.0
17	do----	.9	Silicified limonitic shear zone in siltstone		.0006	.19	N	.056	.076
18	do----	.5	Brecciated siliceous siltstone and shale with bands of iron oxide-----		.002	.16	N	.18	.22
19	do----	.6	Siliceous shear zone 0.33 to 0.5 ft thick in shale and bands of iron oxide-----		.001	2.1	.012	.53	1.3
20	do----	1.0	Shear zone with galena and iron oxide in a 0.02-ft-thick layer-----		.003	3.7	.02	2.7	1.4

Data for samples shown in figure 16, Flagstaff mine--Continued

Sample no.	Sample		Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
	Type	Description					
21	Chip--	0.2 Brecciated shale with minor silicification---	0.0005	0.38	0.0079	0.61	0.70
22	do----	1.3 Shear zone in siltstone with limonite, hematite, and quartz stringers-----	.0002	2.2	.0042	2.3	1.5
23	do----	1.5 Silicified zone with bands of iron oxide and blebs of quartz-----	.003	1.0	.051	.97	3.3
24	do----	6.0 Siltstone with calcite fillings in fractures and minor limonite-----	N	.17	N	.04	.019
25	do----	1.1 Shear zone in siltstone with vuggy quartz- calcite veins and traces of pyrite-----	N	.05	.0026	.019	.12
26	do----	.3 Quartz-calcite vein with jasperoid and limonite after pyrite-----	N	.9	.005	.025	.017
27	do----	.8 Jasperoid zone adjacent to quartz vein and quartz-calcite-veined siltstone-----	N	.02	N	N	.0048
28	do----	1.2 Sheared siltstone with minor limonite-----	N	.04	.0026	.012	.016
29	do----	2.0 Silicified breccia with limonitic, argillic gouge along margins-----	.004	.5	.0057	.25	.11
30	do----	.2 Quartz vein, 0.1 ft thick, and silicified wall rock along contact between breccia zone and limestone-----	N	1.4	.0026	.83	.0071

Data for samples shown in figure 16, Flagstaff mine--Continued

Sample no.	Sample		Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
	Type	Length (ft)						
31	Chip--	1.5	Sheared siltstone and gouge with scattered crystals of oxidized pyrite-----	N	0.48	0.017	0.18	0.095
32	do----	.8	Siltstone with limonite and calcite veinlets	N	.06	.0031	.018	.022
33	do----	1.0	Siltstone with limonite and minor gouge-----	N	.06	.0025	.0063	.0083
34	do----	3.5	Siltstone with limonitic shear zones-----	N	.05	.0082	.0412	.0092
35	do----	.3	Limonitic gouge with scattered calcite veinlets-----	N	.14	.0041	.0340	.0320
36	Select	--	Milky quartz with galena, chrysocolla, ankerite, and limonite from stockpile-----	0.025	18.0	.19	6.0	2.0
37	Chip--	.6	Chalcedonic to opaline silica with disseminated limonite-----	.058	13.6	.098	3.5	2.1
38	do----	.8	do-----	.037	3.8	.064	2.8	.86
39	do----	3.7	Limestone with three thin quartz veins and two shears-----	N	.06	.002	.031	.078
40	do----	1.0	Milky quartz vein with minor limonite-----	N	.02	N	N	.5
41	do----	.2	Dolomite-quartz vein with blebs of tetrahedrite (?), malachite, sphalerite, chalcopryite, and pyrite. Total sulfides <1%-----	.008	7.8	.088	.24	.19

Data for samples shown in figure 16, Flagstaff mine--Continued

Sample					Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
Sample no.	Type	Length (ft)	Description						
42	Chip--	0.4	Dolomite-quartz vein with scattered pyrite and fine-grained galena (?) totaling <1%----		N	0.4	0.0051	0.057	0.058
43	do----	2.0	Quartz vein 0.67 ft thick, in sheared quartzite-----		N	.03	N	.0044	.0098
44	do----	.5	Dolomite-quartz vein with jasperoid, limonite, siderite (?), and calcite. No sulfides observed-----		N	.10	.0023	.047	.022

The mineralized zone at the Flagstaff mine is one of the largest in the area. No evidence to suggest a large hidden ore body was observed, but the possibility cannot be ruled out.

Bud's Hope Mine

The Bud's Hope mine (loc. 66, fig. 2) is near the southern tip of the study area about 600 to 900 ft outside the boundary. It is situated in moderately rugged terrain at elevations of 5,400 to 5,600 ft. Access is via the four-wheel-drive road from Swansea. History and production are unknown. The property is currently claimed by William Brainerd and John Roach of Lone Pine.

A northwest-trending shear zone follows a contact between gray phyllite that forms poor outcrops and an overlying unit of tan phyllite with thinly laminated limestone and siltstone interbeds. The shear is marked by platy fracturing, limonite, argillic gouge along hanging and foot walls, and locally by silicification and quartz veins. The structure was traced for 500 ft along strike and averages 1.75 ft thick (fig. 17). The shear zone is explored by six adits, two shafts, seven prospect pits, and three trenches. Underground workings on the shear zone exceed 600 ft in length.

Quartz veins occur in the adits at locations A and C (fig. 17). The vein in adit A pinches and swells, reaching a thickness of 1 ft. Here the vein carries galena, the only place sulfides were observed in the shear zone. Adits A and C are in the nose of a gentle fold which may have influenced mineralization. There is some thinning of phyllites around the nose, and some beds of gray phyllite appear to wedge out against the shear.

The phyllites are part of the Permian Lone Pine Formation which is faulted against Triassic volcanic rocks. The fault is marked by a dark gray, aphanitic, andesite dike and a zone of limonitic alteration. Two adits and a trench explore copper mineralization along the fault (loc. F). Intense blue and green copper staining and some remnant chalcopyrite are exposed at the trench.

Thirty-five samples were collected (fig. 17). Twenty-nine were chip samples from the principal vein which contained as much as 9.3 oz/ton silver, 1.0 percent lead, and 2.7 percent zinc, and averaged 0.96 oz/ton silver. Samples from the fault zone (nos. 30, 34, and 35) contain as much as 5.2 oz/ton silver, 8.8 percent lead, and 2.6 percent copper.

The principal structure is too thin and low-grade to be minable. Although some high-grade pockets might be found, there is no evidence that they would be large enough to mine. Values from three samples from the fault zone are sufficient to warrant further exploration along this structure.

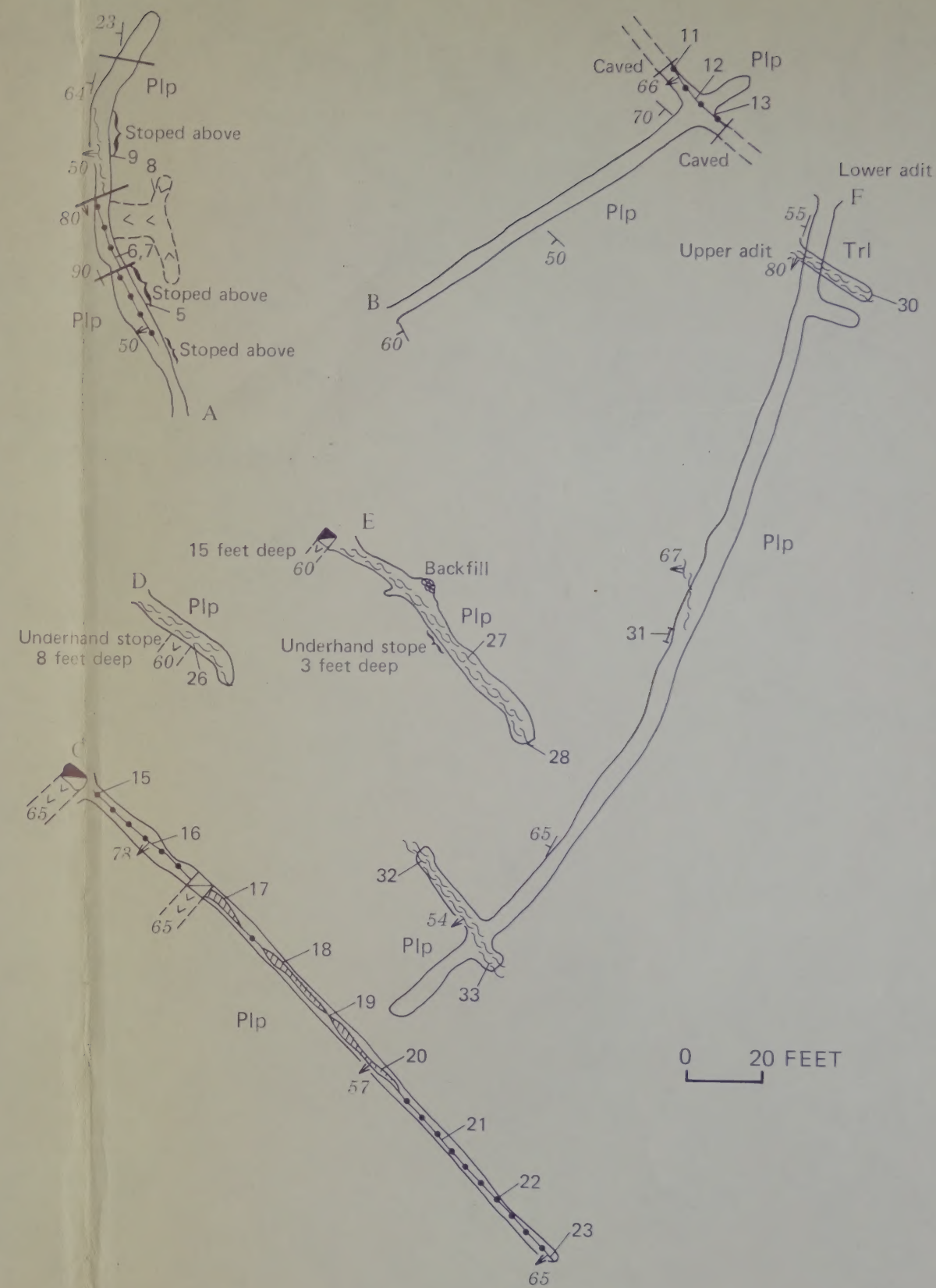
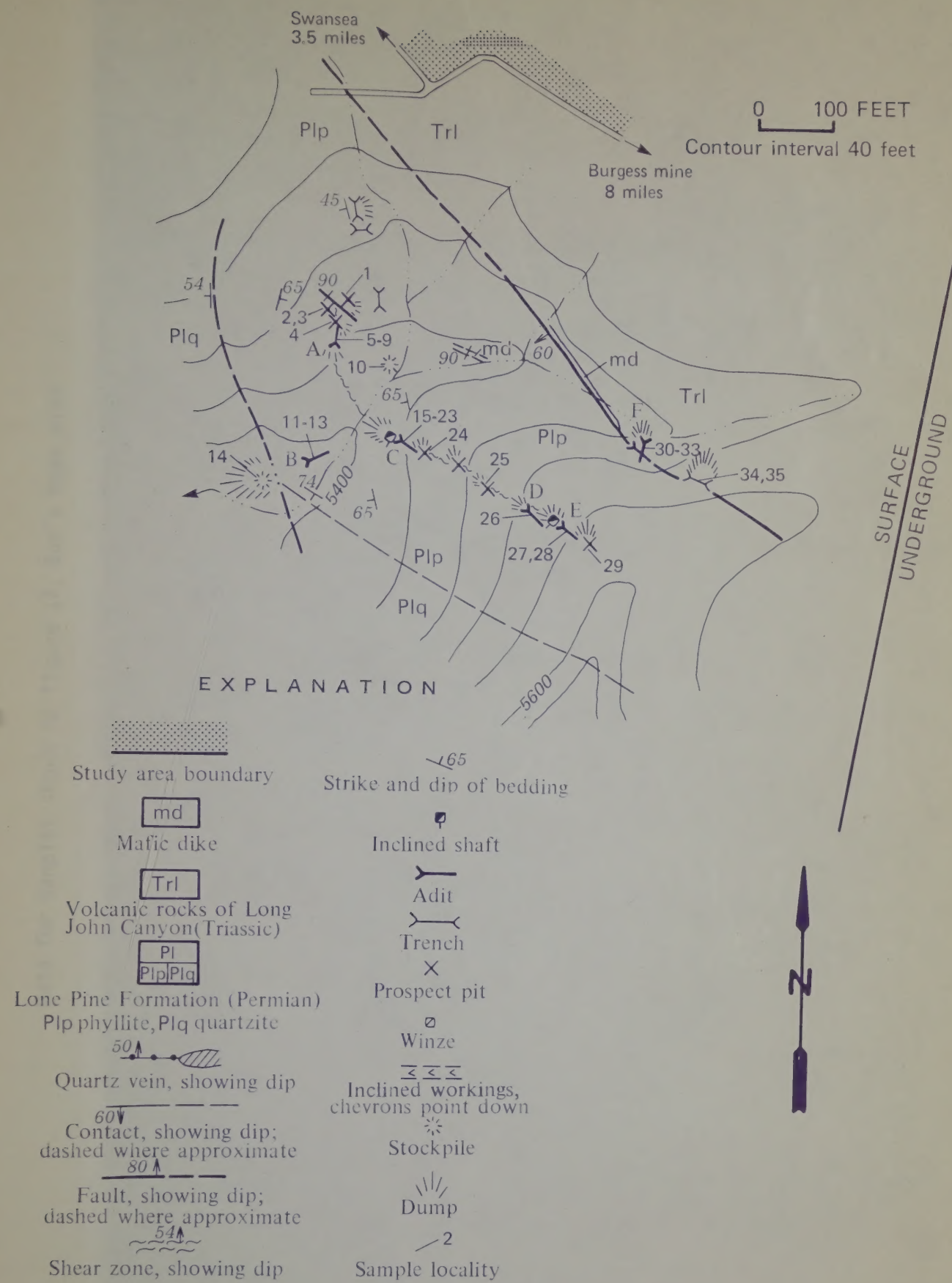


FIGURE 17.—Bud's Hope mine

Data for samples shown in figure 17, Bud's Hope mine

(N, none detected)

Sample					Gold	Silver	Copper	Lead	Zinc
Sample no.	Type	Length (ft)	Description		(oz/ton)	(oz/ton)	(%)	(%)	(%)
1	Chip--	2.7	Sheared phyllite with milky quartz stringers		0.056	0.40	0.0097	0.075	0.047
2	do----	2.2	Sheared, limonitic phyllite in hanging wall of quartz vein-----		.004	.12	.0072	.042	.083
3	do----	1.0	Quartz vein and silicified phyllite with drusy quartz in fractures-----		.10	.8	.01	.19	.14
4	do----	2.8	Milky quartz vein and bedding-plane shear in phyllite-----		.010	1.1	.027	.17	.28
5	do----	3.1	Bedding-plane shear zone with a 0.25-ft-thick quartz vein in phyllite and limestone-----		.025	2.7	.036	.23	1.3
6	do----	2.0	Bedding-plane shear zone in phyllite, limestone, and siltstone above quartz vein		.073	2.0	.055	.44	.3
7	do----	.8	Milky quartz vein with scattered galena, limonite, and chrysocolla-----		.053	8.5	.06	1.00	.74
8	do----	2.2	Bedding-plane shear zone with quartz stringers		.002	.43	.0087	.079	.14
9	do----	2.0	Limonitic bedding-plane shear zone with minor silicification-----		.160	1.8	.019	.13	.12

Data for samples shown in figure 17, Bud's Hope mine--Continued

Sample			Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
Sample no.	Type	Length (ft)						
10	Select	--	Milky quartz with goethite, jasper, limonite, and chrysocolla from small stockpile-----	0.141	18.7	1.7	6.1	0.67
11	Chip--	2.8	Limonitic bedding-plane shear zone in phyllite	.003	.11	.0065	.03	.055
12	do----	.7	Limonitic bedding-plane shear zone with a 0.1- to 0.2-ft-thick band of goethite in phyllite-----	.102	9.3	.15	.56	.79
13	do----	1.7	Limonitic bedding-plane shear zone in phyllite	N	.04	.018	.099	.17
14	Select	--	Milky quartz with weathered pyrite, goethite, and limonite-----	.005	5.8	.041	.23	1.6
15	Chip--	.9	Bedding-plane gouge zone in phyllite-----	.008	.45	.019	.27	.14
16	do----	.5	Limonitic bedding-plane shear zone with 0.01-ft-thick quartz seams in phyllite-----	.046	6.8	.1	.94	2.7
17	do----	3.2	Limonitic bedding-plane shear zone-----	N	.30	.0077	.044	.18
18	do----	2.5	Limonitic bedding-plane shear zones with selvages of phyllite-----	N	.38	.0065	.07	.11
19	do----	1.9	Limonitic bedding-plane shear zone in phyllite with drusy quartz fillings in fractures-----	N	.11	.0041	.028	.028
20	do----	1.6	Limonitic bedding-plane shear zone-----	N	.05	.0042	.0058	.024

Data for samples shown in figure 17, Bud's Hope mine--Continued

Sample		Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
Sample no.	Type							
21	Chip--	1.7	Limonitic bedding-plane shear zone with three siliceous bands-----	0.001	0.02	0.0038	N	0.018
22	do----	1.5	do-----	.001	1.0	.0030	0.01	.015
23	do----	.9	Limonitic bedding-plane shear zone and gray phyllite-----	.042	.07	N	.013	.024
24	do----	.4	Bedding-plane shear zone in thin-bedded limestone and phyllite-----	.003	.50	.035	.26	.29
25	do----	2.1	Bedding-plane shear zone in limestone and phyllite with thin quartz stringers-----	.0007	.43	.0041	.015	.052
26	do----	1.3	Bedding-plane shear zone in phyllite and limestone-----	.028	.239	.03	.11	.081
27	do----	1.8	Limonitic shear zone with quartz stringers in limestone-----	.006	.6	.049	.43	.7
28	do----	1.2	Bedding-plane shear along contact of thinly bedded limestone and phyllite with traces of pyrite-----	.025	.9	.02	.25	.25
29	do----	1.2	Bedding-plane shear along contact of thinly bedded limestone and phyllite-----	.047	.9	.02	.36	.092
30	do----	.7	Chalcopyrite, malachite, and chrysocolla with quartz in fissure-----	.012	5.2	8.8	.064	N

Data for samples shown in figure 17, Bud's Hope mine--Continued

Sample no.	Sample		Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
	Type	Description					
31	Chip--	3.2 Limonitic gouge and silicified phyllite-----	0.002	0.07	0.026	0.021	0.037
32	do----	2.5 Limonitic shear zone with calcite veinlets in phyllite-----	.020	.095	.0027	.024	.031
33	do----	1.5 Shear zone with veins of calcite in phyllite and limestone-----	.024	.153	.0063	.084	.055
34	do----	10.0 Highly fractured silicified rock with pockets and seams of chrysocolla-----	.003	.57	.47	.056	.0071
35	Select	-- Milky quartz and silicified wall rock with secondary copper minerals-----	.007	3.3	2.6	.24	.0001

Industrial Minerals

Talc

The Inyo Mountains are at the northwest end of a belt of talc occurrences that stretches 150 mi southeast across Death Valley. There were several major producers in the Talc City Hills area, 20 to 25 mi southeast of the study area (Page, 1951). Four deposits on the east side of the Inyo Range have reserves, and two have had recent production (Close, 1985).

Talc occurrences in and adjacent to the study area are small lenses that formed in Hidden Valley Dolomite along faults, shears, and intrusive contacts. All are too small to mine profitably.

High-grade talc was mined during World War II from the Long Trail deposit (loc. 55, fig. 2) which is on the southwestern boundary of the study area. The largest lens has dimensions of about 50 by 20 by 5 ft. Only about 1,000 tons were mined.

The only other notable occurrence within the study area is an outcrop of exceptionally pure talc at an unnamed prospect south of the Long John mine (loc. 51, fig. 2). The occurrence is poorly exposed, and its dimensions are not known.

The Lakeview talc mine (fig. 2), located outside the southwestern WSA boundary, shipped a small quantity of talc in 1947 (Ver Planck, 1966). The talc occurred in lenses between the Eureka Quartzite and Ely Springs Dolomite. The deposit is said to be mined out (Page, 1951). Other occurrences outside the WSA were noted at the Black Warrior, Delthe Black Warrior, and Lucky Slim mines.

Dolomite Marble

Dolomite marble has been quarried from exposures of metamorphosed Hidden Valley Dolomite along the southwest edge of the Inyo Mountains (fig. 2). The quarries were opened in 1885 (Dunn, 1909) and produced 78,400 cubic ft of architectural marble, valued at \$219,300, between 1894 and 1914 (Logan, 1947, p. 244). In later years, the marble was sold in crushed form for use in the soda ash industry and for production of carbon dioxide. The Inyo Marble Company continues to produce crushed marble for various uses including roofing granules and soil supplements from quarries on 480 acres of patented claims. Reserves on these claims are ample to meet expected demand in the foreseeable future.

Quartzite

Several tens of thousands of tons of exceptionally pure Eureka Quartzite were quarried from deposits at the Lakeview talc mine (fig. 2) between 1956 and 1966 for the manufacture of super duty silica brick (Ver Planck, 1966). The quarries are about 0.5 mi outside the WSA and are now idle.

APPRAISAL OF MINERAL OCCURRENCES

To be economically minable, each silver-lead-zinc occurrence in the southern Inyo Mountains must meet minimum criteria of size and grade. A deposit must have sufficient value to pay all the costs of mining and ore processing and return a reasonable profit. Costs include exploration, feasibility studies, labor, loan and interest payments, utilities, road construction and maintenance, purchase and/or lease of equipment, and transportation of concentrates to market or unprocessed ore to a custom mill (the nearest operating custom mill is 160 mi by road from Lone Pine to the Sixteen-to-One mine in Esmeralda County, NV). With the possible exception of veins at the Reward and Silver Spur mines, none of the occurrences examined in this study meet the criteria for economic mineral deposits. Most of the veins in the study area are on the order of 1 ft thick, relatively low in grade, and with discontinuous mineral-rich zones. Detailed mapping, sampling, and drilling would show if ore reserves are present at the Reward and Silver Spur mines.

Although none were discovered during this study, the possibility of an economic silver-lead-zinc deposit in the study area cannot be ruled out. Mineral deposits have been found at numerous sites in the area, and there were at least five past producers. In recent years, depressed silver and base-metal prices have caused closures of mines throughout the western United States. Dramatic increases in prices of precious and base metals would stimulate exploration in the study area. This study identifies several locations or trends where deposits might occur. Among these are:

The Reward trend--a belt of significant mineral occurrences near the axis of the Reward anticline;

The Spanish Belt trend--a 4,000-ft-long zone of mineralized shears in diorite that has only been partially explored;

The New York Butte area--a possible northwest extension of a mineralized belt in the Burgess mine area;

The Long John trend--a belt of gossan zones similar in surface expression to the Long John deposit;

The San Pablo prospect--a possible extension of the vein which is obscured by soil;

The Pennsylvania mine area--two partially explored structures and the possibility of a third being found.

Exploration of these areas would include detailed surface and underground geologic mapping and collection of sample data by means of geochemical and geophysical surveys and drilling of favorable targets.

Occurrences of talc in the study area are too small to develop. Talc deposits on the east side of the Inyo Mountains and the Talc City Hills are large enough to satisfy local markets in the foreseeable future. It is unlikely that demand for talc will increase to the point that exploration for new deposits would be warranted. Deposits of dolomite marble do not extend into the WSA.

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Map No.	Location	Summary	Geologic and Structural	Length and Width of area
1	Barren	A quartz vein with chalcopyrite and secondary copper minerals in its matrix, and alluvial quartz minerals. Chalcopyrite and secondary minerals, all minerals also occur in the matrix. The vein strikes N. 30° W. Dips 30° SE, and extends from 10 to 20 ft thick. It is located on the crest of the hills of the pits.	The vein is 10 to 20 ft thick. It is located on the crest of the hills of the pits.	The vein is 10 to 20 ft thick. It is located on the crest of the hills of the pits.
2	Barren	Four samples of a quartz-chalcopyrite vein in a matrix of secondary minerals. The vein also contains secondary minerals and chalcopyrite minerals. It strikes N. 30° W. Dips 30° SE, and extends from 10 to 20 ft thick. It is located on the crest of the hills of the pits.	The vein is 10 to 20 ft thick. It is located on the crest of the hills of the pits.	The vein is 10 to 20 ft thick. It is located on the crest of the hills of the pits.
3	Barren	Quartz-chalcopyrite vein in a matrix of secondary minerals. The vein also contains secondary minerals and chalcopyrite minerals. It strikes N. 30° W. Dips 30° SE, and extends from 10 to 20 ft thick. It is located on the crest of the hills of the pits.	The vein is 10 to 20 ft thick. It is located on the crest of the hills of the pits.	The vein is 10 to 20 ft thick. It is located on the crest of the hills of the pits.
4	Barren	Quartz-chalcopyrite vein in a matrix of secondary minerals. The vein also contains secondary minerals and chalcopyrite minerals. It strikes N. 30° W. Dips 30° SE, and extends from 10 to 20 ft thick. It is located on the crest of the hills of the pits.	The vein is 10 to 20 ft thick. It is located on the crest of the hills of the pits.	The vein is 10 to 20 ft thick. It is located on the crest of the hills of the pits.
5	Barren	Quartz-chalcopyrite vein in a matrix of secondary minerals. The vein also contains secondary minerals and chalcopyrite minerals. It strikes N. 30° W. Dips 30° SE, and extends from 10 to 20 ft thick. It is located on the crest of the hills of the pits.	The vein is 10 to 20 ft thick. It is located on the crest of the hills of the pits.	The vein is 10 to 20 ft thick. It is located on the crest of the hills of the pits.

APPENDIX

SUMMARY TABLE OF MINES PROSPECTS IN AND ADJACENT TO THE SOUTHERN INYO STUDY AREA

APPENDIX.--Mines and prospects in and adjacent to the Southern Inyo study area

Map no.	Name	Summary	Workings and production	Sample and resource data
1	Unnamed	A quartz vein with chalcopryrite and secondary copper minerals is in iron-stained and altered quartz monzonite. Limonite and goethite bands, blebs, and boxworks also occur in the quartz. The vein strikes N. 51° W., dips 38° NE., and ranges from 0.2 to 0.5 ft thick. It could not be traced beyond the limits of the pit.	One prospect pit; no production.	One chip sample of vein contained 0.3 oz/ton silver, 1.1% copper, 0.0029% lead, and 0.0068% zinc.
2	Valley View	Poor exposure of a quartz-limonite vein in hornblende-biotite monzonite is associated with a pegmatite dike. The vein also contains siliceous limonite and chalcedonic quartz. It strikes west, dips steeply north, and is 0.2 ft thick. Vein float was traced for about 300 ft along the trenches.	Four shallow trenches; no production.	One select and one chip sample were taken of vein material. The chip sample contained 0.2 oz/ton silver. No other anomalous metal values were found.
3	Unnamed	Siliceous limonite zone is in altered monzonite. It strikes N. 30° W., dips 65° SW., and is 1.2 ft thick. Zone could be traced by float for about 200 ft.	One prospect pit; no production.	One chip sample from the zone contained 0.01% copper, 0.013% lead, and 0.12% zinc.
4	Rolling Thunder No. 3	Two quartz veins and a silicified zone are exposed in quartz monzonite near the Pat Keyes Trail. The silicified zone strikes N. 67° E., dips 75° NW., and is in a 5-ft-thick shear zone. One quartz vein strikes N. 30° W., dips 38° SW., and is as much as 1.0 ft thick; the other vein strikes N. 40° E., dips 10° NW., and is as thick as 1.6 ft. The silicified zone contains quartz veinlets, limonite, and gouge. The quartz veins contain some vugs with limonite and boxwork, iron-stained carbonate, and ferruginous quartz.	None.	Three chip samples from the veins and silicified zone contained from 0.00075% to 0.0050% zinc; two contain 0.0025% and 0.0057% copper.
5	Peacock Nos. 1 and 2	A north-trending zone of yellow-green argillic alteration, with jasperoid veins as thick as 1.8 ft, extends 85 ft in recrystallized, marly limestone and dolomite. No ore minerals were observed in place, but secondary copper minerals were found in a stockpile.	Two adits, 16 and 42 ft long. No apparent production.	Two chip samples of jasperoid veins contained minor gold, silver, copper, and lead, and 0.13% and 2.0% zinc. Two grab samples from stockpiles contained 2.4 and 0.28 oz/ton silver, 2.8% and 0.47% copper, and 2.6% zinc.
6	Unnamed	A northwest-trending quartz vein contains pockets of limonite, galena, and chalcopryrite. The vein averages 1.1 ft thick and was traced underground for 140 ft. The vein is in dolomite marble adjacent to a contact with intrusive diorite.	One adit, 140 ft long. No apparent production.	Three chip samples of the vein averaged 0.47 oz/ton silver, 4.03% zinc, and 0.44% lead.

APPENDIX.--Mines and prospects in and adjacent to the Southern Inyo study area--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
7	Unnamed	A 2-ft-thick quartz lens in diorite is exposed on a dip slope that is 90 by 15 ft. Pockets of spongy limonite and small amounts of galena are in the quartz.	One 40-ft adit. No production evident.	Five chip samples and one select sample of quartz had no significant metal content.
8	Unnamed	A shear zone in diorite is partially replaced by vein quartz containing argentiferous galena, limonite, jasperoid, chalcopryite, malachite, and chrysocolla. The shear can be traced for 110 ft along the surface and 20 ft in depth. It ranges from 0.2 to 1.5 ft thick.	Two 10-ft adits and one prospect pit. No production.	Three samples: one chip sample from the zone contained 0.067 oz/ton silver, 0.025% copper, 0.12% lead, and 0.14% zinc. One select sample of quartz contained 0.015 oz/ton gold, 12.8 oz/ton silver, 0.83% copper, 1.8% lead, and 0.049% zinc. Another select sample of quartz contained 0.064 oz/ton silver, 0.0026% copper, and 0.012% lead.
9	Frostbitten	A milky quartz vein in diorite strikes N. 50° to 80° W. and dips 10° to 40° NE. It averages 1.2 ft thick and is exposed for 250 ft along strike and 110 ft down dip. The vein contains abundant limonite blebs and stringers, some galena, and minor chalcopryite, malachite and chrysocolla. A 3-ft-thick shear zone with quartz stringers is exposed 200 ft north of the inclined shaft.	One 110-ft inclined shaft and one 34-ft open cut. No production is evident.	Six chip samples and one select sample of quartz and shear material were collected. Two chip samples contained 0.007 and 0.0016 oz/ton gold. One chip contained 0.069 oz/ton silver, and three contained 0.0052% to 0.01% lead. Four contained only minor amounts of zinc.
10	International Recovery	Four quartz veins in a shear zone in quartz monzonite are exposed up to 970 ft along the surface. They are partially folded and faulted. The veins strike from N. 60° W. to N. 50° E., dip generally less than 45° to the northeast and southwest, and range from 0.5 to 7.0 ft thick. The quartz contains stringers, blebs, and boxworks of limonite, pseudomorphs of pyrite, chalcopryite, pyrite, galena, and calcite.	One 38-ft inclined shaft, two caved adits, one 25-ft open cut, two trenches, and two prospect pits. No known production; 60 tons of vein material stockpiled.	Thirty-six samples of quartz were collected. One select sample from the stockpile contained 0.01 oz/ton gold; one select sample from the open cut contained 0.07 oz/ton gold, 0.1 oz/ton silver, 0.13% copper, and 0.014% lead. All but four of the 34 chip samples had negligible metal content. The four samples, representing two vein segments, averaged 0.17 oz/ton gold, 2.4 oz/ton silver, and 1.3% copper. Further prospecting is warranted in the area of these vein segments.
11	Unnamed	Shear zones containing quartz and siliceous limonite vein material are in an area of faulting and hydrothermal alteration in quartz monzonite. Quartz veins contain chalcopryite, chrysocolla, malachite, limonite, and goethite. A pod of limonitic jasper and gossan in a gouge zone was exposed in the open cut. Shear zones strike N. 40° to 86° E., dip 85° NW. to 85° SE., are as wide as 8 ft, and extend from 20 ft to more than 100 ft in length.	One 11-ft open cut, two prospect pits. No production.	One select and two chip samples of quartz and shear zone material were collected. The select sample contained 0.66 oz/ton gold, 0.4 oz/ton silver, 0.9% copper, 0.042% lead, and 0.012% zinc. A 0.2-ft chip sample contained 0.19 oz/ton gold, 0.1 oz/ton silver, 0.25% copper, 0.012% lead, and 0.005% zinc. A 2-ft chip sample contained no detectable gold or silver, 0.09% copper, 0.0082% lead, and 0.0052% zinc.

Map no.	Name	Summary	Workings and production	Sample and resource data
12	Unnamed	Quartz and limonitic jasper vein is in a shear zone in monzonite. Vugs in the vein contain iron-stained quartz crystals. Limonitic jasper contains limonite boxworks and goethite. The vein strikes N. 60° W., dips 15° NE., ranges from 0.4 to 1.2 ft thick, and is about 35 ft long. It is an extension of the International Recovery vein system.	One prospect pit; no production.	Two chip samples of the vein had no significant metal content.
13	Unnamed	Shears and siliceous limonite zones in quartz monzonite are partially replaced by quartz veins with associated chrysocolla, malachite, limonite, hematite, goethite, and specular hematite. The main shear zone strikes N. 40° W. to N. 40° E., dips 55° SW. to 80° NW., and ranges from 0.4 to 1.4 ft thick. It is exposed for 90 ft along strike and 24 ft downdip. A shear zone with a siliceous limonite vein is exposed 120 ft northeast of the main workings. It strikes north to N. 22° W., dips 65° to 75° W., averages 1.2 ft thick, and extends 100 ft along the surface.	One caved adit, one 24-ft inclined shaft, two open cuts, and one prospect pit. No production.	Twelve samples from the main shear zone were collected. Nine contained from trace to 0.29 oz/ton gold. One chip sample of a cross shear contained 2.0 oz/ton silver, 13.6% lead, 5.6% zinc, 0.66% copper, and trace gold.
14	Unnamed	A series of three parallel shear zones in quartz monzonite contain quartz veins, argentiferous galena, hemimorphite, limonite, hematite, calcite, secondary copper minerals, and silicified country rock. They strike from N. 50° to 70° W., dip 50° to 85° NE., range from 0.6 to 3.5 ft thick, and are exposed for 45 ft, 90 ft, and 155 ft. The structures are aligned with similar shears 2,000 ft to the southeast at the Spanish Belt prospect (Location 15).	Four adits, from 8 to 20 ft long, one 35-ft inclined shaft with a 25-ft drift, and two prospect pits. No production.	Seventeen chip samples from the shear zones averaged 0.01 oz/ton gold, 2.3 oz/ton silver, 0.11% copper, 6.9% lead, and 2.7% zinc.

Map no.	Name	Summary	Workings and production	Sample and resource data
15	Spanish Belt	Two partially mineralized shear zones in diorite contain quartz, argentiferous galena lenses, limonite, gouge, minor secondary copper, and silicified country rock. The shear zones strike N. 37° to 88° W., are steeply dipping generally to the southwest, range from 0.6 to 1.8 ft thick, and are exposed for 110 and 120 ft. The shear zone may extend between the workings along a northwest structural trend for 850 ft. About 550 ft to the southeast, quartz vein float is south of an east-trending felsic dike. The quartz contains galena, chalcopyrite, chrysocolla, malachite, limonite, hematite, and siderite. The float was traced for 50 ft and suggests a north-trending vein 0.2 to 0.3 ft thick. The veins are aligned with structures 2,000 ft to the northwest at Loc. 14, and mineralization is similar.	Two adits, 43 ft and 55 ft long, two open cuts 10 ft and 17 ft long. No production.	Two select and nine chip samples from shear zones were collected. Nine chip samples averaged 0.02 oz/ton gold, 0.46 oz/ton silver, 0.03% copper, 0.67% lead, and 0.62% zinc. One select sample from the stockpile contained 41.1 oz/ton silver, 25.1% lead, 0.01 oz/ton gold, 0.25% copper, and 0.34% zinc. A select sample from a quartz vein contained 5.2 oz/ton silver, 0.01 oz/ton gold, 5.8% lead, 2.6% copper, and 0.098% zinc. Further prospecting is warranted along the trend from Loc. 14 to Loc. 15 to determine continuity and possible resources.
16	Reward mine area	Several veins occur near and parallel the axis of a northwest-trending anticline in the Keeler Canyon Formation. The Brown Monster and Reward (Hirsch) veins contain gold, silver, lead, and zinc minerals in as much as 16-ft-thick zones at the anticline axis but are generally barren on the east limb where they extend into the study area. Other veins along and to the east of the anticline axis are locally mineralized.	The Brown Monster vein is developed by a 550-ft inclined shaft, extensive stopes, and a 1,700-ft crosscut. The Reward vein is developed by seven levels totaling about 5,300 ft of drifts and crosscuts. Elsewhere on the property are 12 adits (all less than 120 ft), 5 shafts, and about 2 dozen prospect pits. Production from the Brown Monster, Hirsch, Eclipse, F. D. Roosevelt, and Golden West mines totals about 19,370 oz gold, 102,600 oz silver, 30,980 lb copper, and 203,300 lb lead.	Sixty samples: 1 chip sample contained 1.49 oz/ton gold; 5 chip and 5 select samples contained 0.114 to 0.81 oz/ton gold, 9 chip and 2 select samples contained 0.01 to 0.089 oz/ton gold; and 36 chip, 1 select, and 1 random sample contained less than 0.01 oz/ton gold. Three select samples contained from 10.2 to 42.0 oz/ton silver; 10 chip and 1 select sample contained from 1.9 to 9.83 oz/ton silver, 41 chip, 4 select, and 1 random sample contained less than 0.631 oz/ton silver. Three select and two chip samples contained from 1.1% to 5.7% copper; two select and five chip samples contained from 0.12% to 0.48% copper. Two select and 1 chip sample contained 20.3% to 29.8% lead; 1 select and 10 chip samples contained 1.0% to 8.4% lead. Although several samples contained significant silver, gold, copper, lead, and zinc, none represented sufficient tonnage to calculate resources. Detailed mapping and systematic drilling would be needed to establish resources.
17	Annex-Arrow group	Northerly to westerly trending, steeply dipping, shear zones occur in granitic intrusive and banded marble-hornfels metasedimentary rocks. The zones locally contain vein quartz and silver, copper, lead, and zinc minerals. The longest shear zone is exposed intermittently for about 240 ft and averages 1.8 ft thick.	One 25-ft shaft, a 78-ft adit, three trenches up to 30 ft long, a 10- by 10-ft open cut, and a prospect pit.	Ten chip samples from shear zones: each contained from 0.1 to 1.0 oz/ton silver, two samples contained 0.34% and 0.45% copper, two contained 0.41% and 0.91% lead, and 0.18% and 0.96% zinc.

Map no.	Name	Summary	Workings and production	Sample and resource data
18	Julie L.	Two veins containing quartz, calcite, and limonite occur in diorite. One vein strikes N. 23° W., dips 64° SW., and is exposed for about 50 ft. The other could not be traced beyond workings.	Two prospect pits.	Two samples: a grab sample from a 25-lb stockpile contained 0.1 oz/ton silver, 0.56% lead, and 0.004% zinc. A select sample from a small dump contained 0.01 oz/ton gold, 0.1 oz/ton silver, 0.0011% copper, 0.0440% lead, and 0.0040% zinc.
19	Sweet Thing No. 2	Two northwest-trending shear zones about 100 ft apart cut thinly banded greenish-gray to light-gray hornfels and marble, and a chlorite-bearing intrusive. Vein quartz occurs intermittently along the structures for 120 and 240 ft, respectively, and are as much as 1 ft thick.	One 15-ft-deep shaft, eight prospect pits, and trenches from 5 to 25 ft long.	Seven samples from shear zones: four chip samples contained from 0.1 to 0.7 oz/ton silver, less than 0.02% copper, 0.02% to 0.27% lead, and 0.009% to 0.19% zinc; three select samples from small stockpiles contained 16.5, 7.2, and 4.9 oz/ton silver; 18.1%, 8.9%, and 7.8% lead, as much as 0.2% copper, and as much as 3.0% zinc.
20	Inyo Bee	A barite-calcite vein, 3.4 ft thick, strikes N. 5° W. and dips 85° NE. in calcareous siltstone.	One 13-ft shaft and some bulldozer cuts.	One sample of the vein contained 0.017 oz/ton silver, 0.15% zinc, and about 50% barite.
21	Lucky Slim	Several northwest-trending shear zones dip steeply in siltstone, marble, and quartzite. Quartz veins and silicified zones locally are as much as 1 ft thick but generally are less than 0.5 ft. No veins were exposed for more than 30 ft. Talc occurs along one shear zone and locally is as thick as 3 ft.	Five shafts as deep as 23 ft; six adits, one about 310 ft long, the others less than 65 ft; four trenches; and several prospect pits. Although no production is recorded, the presence of small stopes suggests minor production.	Twenty chip samples of the shear zone: five contained from 1.4 to 8.1 oz/ton silver, the others contained less than 0.79 oz/ton silver. All contained 1% or less copper. Eight contained from 1.1% to 7.9% lead; the others contained less than 0.77% lead. Eight contained from 1.1% to 8.6% zinc; the others contained less than 0.57% zinc. Three samples from altered zones contained talc as a major constituent.
22	Pinyon (Poorchild-Raven)	A series of quartz veins containing galena, chalcopryite, sphalerite, and pyrite occur near the axis of a northwest-trending anticline. The veins are in banded hornfels and marble of the Keeler Canyon Formation and in granitic dikes and sills that intrude the anticline. Most of the veins are short, but one was traced about 400 ft and averaged 0.5 ft thick.	Twelve adits, one shaft, and 10 prospect pits; total underground workings of about 740 ft. Gold production of \$4,500 is reported for the White Hill mine at this approximate location.	Forty-four samples of quartz were collected. Eight samples from the 400-ft vein, representing about 4,000 tons of vein material, had weighted averages of 4.9 oz/ton silver, 2.9% lead, and 5.0% zinc. Four samples from a 150-ft-long vein had weighted averages of 4.9 oz/ton silver, 0.5% copper, 3.9% lead, and 1.4% zinc; the vein averaged 0.9 ft thick where sampled.

APPENDIX.--Mines and prospects in and adjacent to the Southern Inyo study area--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
23	Old Grindstone	Two segments, 200 and 140 ft long, of a vein which may extend 850 ft are exposed. The vein pinches and swells reaching a maximum thickness of 5 ft, averaging 1.4 ft. A second, parallel vein is 350 ft to the northwest. Galena, chalcopryite, and secondary lead and copper minerals occur in the veins. Host rock is quartzite of the Lone Pine Formation.	Three adits, 115, 55, and 8 ft long, one 20-ft shaft, three pits, and one glory hole. Production is unknown.	Eleven chip and three select samples were collected. Samples from the two exposed vein segments averaged 0.92 and 0.25 oz/ton silver, and 1.2% and 0.16% lead. Select samples contained as much as 17.1 oz/ton silver and 18.3% lead. If the two segments are continuous, then 18,000 tons could be present, but the average grade is too low and the vein too thin to mine economically. Additional work is warranted to ascertain the presence of resources.
24	Silver Spur	An east-trending quartz vein, 6 to 20 ft thick, in a zone in Triassic marine sedimentary rocks is exposed for 4,000 ft along strike. The vein contains galena in pods and disseminations, chalcopryite, pyrite, and iron oxides.	The vein was developed by 3,000 ft of underground workings in 8 adits. The foundation of a mill and a loading bin remain. The vein yielded 100,000 oz silver prior to 1902. Additional silver, gold, lead, and copper were produced until 1939.	The owner refused the USBM permission to map and sample the mine. High-grade silver-bearing material probably remains in the the vein, but its tonnage and grade is unknown.
25	Cheri No. 20	A 1.4-ft-thick quartz vein in thinly bedded limestone of the Lone Pine Formation trends east for 135 ft. The vein contains galena, chrysocolla, and azurite. The vein is an extension of the Silver Spur vein and continues 4,000 ft eastward to Loc. 26.	Two inclined shafts, 50 ft and 75 ft deep, are 110 ft apart on the vein. The deeper shaft may have 100 ft of workings. Production is unknown.	Three surface chip samples of the vein averaged 1.75 oz/ton silver and 4.89% lead.
26	Unnamed	A quartz vein, 2.6 to 3.2 ft thick is exposed for 1,000 ft in argillized limestone and gouge along a ridge line. The vein is probably an extension of the Silver Spur-Cheri No. 20 structure.	Two prospect pits and two crosscut adits, 30 and 10 ft long. The adits did not reach the structure.	Two chip samples from the vein were barren of metal content.
27	San Pablo	A north-trending shear zone in metasedimentary rocks of the Keeler Canyon Formation is exposed for 200 ft and may extend an additional 165 ft. The average width of the exposed part of the zone is 1.8 ft. Discontinuous bands and stringers of quartz and jasperoid in the zone contain sulfides and secondary copper and lead minerals.	Three adits, 95, 30 and 15 ft long, one cut, and one trench. Probably no production.	Six chip samples from the shear zone averaged 5.84 oz/ton silver, 8.52% lead, and 1.03% zinc. Two select samples contained 1.94 and 3.06 oz/ton silver, 14.2% and 18.3% lead, and 0.55% and 0.23% zinc. Additional work might disclose resources.
28	Howard No. 7	A weakly argillized northwest-trending fault in volcanic rocks was prospected.	One 16-ft-long cut. No production.	One chip sample from the fault had no significant metal content. The owner reported platinum values, but no platinum was detected.

APPENDIX.--Mines and prospects in and adjacent to the Southern Inyo study area--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
29	Cynthia Nos. 1-22	A series of northwest-trending shear zones, as long as 800 ft, in volcanic rocks were prospected. The shears are argillically altered and locally contain disseminated pyrite and secondary copper minerals.	Two adits, 39 and 51 ft long, one 10-ft shaft, 3 prospect pits, and the ruins of a cabin in an area about 2,500 ft square. No apparent production.	Eleven chip samples from shear zones were collected. Ten had low precious and base metal content. One from a zone of malachite- and chrysocolla-lined fractures contained 0.8 oz/ton silver, and 3.9% copper. Platinum was reported to be present by the owner, but none was detected.
30	Golden Lady	A 2-ft-thick quartz vein with traces of galena and copper minerals extends 40 ft in volcanic rocks at the adit and is terminated at both ends. At the shaft, a shear zone trends east in volcanic rocks for 100 ft. Traces of chalcopyrite and secondary copper minerals occur in veinlets along the shear.	One 20-ft adit and two prospect pits. One thousand five hundred ft to the northwest is a 15-ft shaft. Probably no production.	Two samples from stockpiles at the shaft had no significant metal content. Two samples from stockpiles at the adit contained 5.45 and 0.93 oz/ton silver, 0.83% and 0.81% copper, 21.2% and 0.69% lead, and 1.1% and 0.2% zinc. A chip sample from the vein had no significant metal content.
31	Hummingbird	A northeast-trending shear zone, 8 ft long and 1 ft thick, in hornfels contains quartz stringers with traces of pyrite and secondary copper minerals.	One prospect pit. No production.	One chip sample from the shear zone had no significant metal content.
32	Hancock No. 1	A northwest-trending shear zone in hornfels is exposed for about 250 ft. The shear contains quartz stringers as thick as 0.1 ft which locally contain minor chalcopyrite and secondary copper minerals.	Two prospect pits about 250 ft apart. No production.	Two of three chip samples from the shear zone had no significant precious or base metal content. The third from the northwestern pit contained 1.05 oz/ton silver, 0.46% copper, 0.0034% lead, and 0.12% zinc.
33	Patent Pending	A northwest-trending quartz vein in diorite is exposed for 20 ft along strike. It is as thick as 0.5 ft and contains scattered crystals of galena and chalcopyrite.	One 12-ft shaft. No production.	One grab sample from a stockpile contained 2.6 oz/ton silver, 0.66% copper, 3.1% lead, and 0.25% zinc.
34	Duarte	A northwest-trending fault in Triassic andesite extends more than 700 ft along strike. One copper-stained quartz stringer, 0.2 ft thick and 10 ft long, was the only mineralization observed.	Four adits, 95, 85, 13, and 10 ft long.	One of six chip samples from the shear zone contained 0.68 oz/ton silver and 5.0% lead. The others had low metal content.
35	Unnamed	A series of north to northwest-trending shears in andesitic volcanic rocks contain galena and chalcopyrite in quartz-calcite veins. The veins are as thick as 1.2 ft but are generally less than 0.5 ft and are not persistent along strike.	Two adits, 52, and 34 ft long, one trench and three prospect pits.	Seven samples of shear zone material: of two select samples, one contained 12 oz/ton silver, 0.25% copper, 22.2% lead, and minor zinc. The other samples contained minor amounts of silver, copper, lead, and zinc.

APPENDIX.--Mines and prospects in and adjacent to the Southern Inyo study area--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
36	Unnamed	An east-trending fracture zone in Triassic volcanic rocks contains pods and discontinuous veins of quartz. The largest vein observed is 25 ft long, but it appears to be cut off at depth by a low-angle fault. Small amounts of chalcopryite, malachite, and galena occur in the veins.	Two adits, 10 and 40 ft long.	Five samples: one select sample of quartz from a 200-lb stockpile contained 0.4 oz/ton silver, 0.18% copper, 0.74% lead, and 0.40% zinc. Four chip samples of fracture zone material contained minor amounts of silver, copper, lead, and zinc.
37	Unnamed	A diorite dike in quartz monzonite trends N. 40° W. for 1,000 ft. Secondary copper minerals are along the trend, and silver-bearing quartz stringers, about 0.3 ft thick, are exposed in prospect pits.	Two prospect pits about 1,000 ft apart. No production.	A select sample of quartz from the northwestern pit contained 5.72 oz/ton silver, 8.9% lead, 1.9% copper, 0.084 oz/ton gold and 0.021% zinc. A random chip sample of quartzose material from the southeastern pit contained 17.4 oz/ton silver, 0.36% copper, 0.042% lead, 0.046% zinc, and no gold. Limited exposure precludes estimation of resources. Further prospecting is warranted.
38	Unnamed	Limonitic joints with northwest-trending quartz stringers in quartz monzonite were prospected.	One inaccessible shaft, four trenches, two prospect pits in an area about 800 ft ² . No production.	Five select samples of quartzose material contained 0.019 to 0.344 oz/ton silver, 0.0016 to 0.074 oz/ton gold, 0.001% to 0.61% lead, and insignificant copper and zinc.
39	Unnamed	A quartz vein occurs in a limonitic zone in quartz monzonite. The vein is not exposed, but vein material is present in a stockpile.	One prospect pit. No production.	One select sample of quartz from the stockpile contained 0.072 oz/ton silver, 0.066% lead, and insignificant copper, zinc, and gold.
40	Macaroon	Quartz stringers associated with limonitic joints in quartz monzonite occur at three of the workings. The veins are not exposed, but vein material is present in stockpiles.	Four prospect pits and two collapsed shafts were developed in an area of about 350 by 150 ft. No production is known.	Three select samples of vein material from stockpiles contained 0.09 to 0.79 oz/ton silver, 0.006 to 0.038 oz/ton gold, 0.12% to 2% lead, 0.002 to 0.072% copper, and 0.059% to 0.29% zinc.
41	Million Dollar Baby	Several small diorite and aplite dikes trend east in quartz monzonite. One quartz vein, which is exposed for 70 ft in underground workings, contains visible galena and pyrite. The vein strikes north, dips 8° west, and pinches and swells between 0.1 and 1.0 ft in thickness.	Two adits are about 600 ft apart in the bottom of a steep-sided drainage about 0.5 mi west of the Burgess mine. One adit is 70 ft long; the other is 125 ft long. No production is known.	Four samples from the vein in the 70-ft adit contained 1.02 to 3.85 oz/ton silver, 0.76% to 2.5% lead, 0.12% to 5.5% zinc, 0.001 to 0.011 oz/ton gold, and 0.016% to 0.0078% copper. Four samples from the 125-ft adit contained no significant values.

Map no.	Name	Summary	Workings and production	Sample and resource data
42	Burgess mine area	The area is underlain by volcanic and sedimentary rocks of Triassic age. A poorly exposed zone of quartz veins along faults in limestone, shale, and quartzite trends northwest and dips 35° to 50° southwest. The zone is 80 to 100 ft wide, at least 3,800 ft long, and apparently extends to the north in quartz monzonite into the study area.	Underground workings include a 156-ft inclined shaft, a 700-ft crosscut adit, and 2,000 ft of drifts. There are 64 prospect pits, 12 inclined shafts, 6 shafts, 12 trenches, and 10 adits in the mine area. Nearly all the underground workings are caved. In 1910, 46 tons of ore were shipped which yielded 22 oz gold and 11 oz silver. Ore milled in 1919 was valued at \$20 to \$40 per ton.	The Burgess mine area was previously mapped and sampled as part of a USBM wilderness appraisal of the eastern side of the Inyo Range (Close, 1985, 1986). In addition, 13 grab or select samples of vein material were taken from dumps during this study. Six samples contained more than 0.1 oz/ton silver with a high of 8.5 oz/ton. Lead values in excess of 1% were reported in four samples with a high of 4.8%, and one zinc value above 1% was reported at 1.6%. There were no copper values above 0.15% and negligible gold values were reported. Close (1986) reports similar values and concludes that the metal-bearing occurrences are numerous but scattered, poorly exposed, discontinuous, and diversely oriented. Stockpiles contain good metal values, but in most instances, nearby structures do not.
43	Unnamed	A small, isolated zone of thin calcite veinlets in Triassic andesite was prospected.	One inclined shaft, 20 ft deep. No production.	One select sample from the dump had no significant metal content.
44	Far Ridge	A limonitic quartz vein in Triassic andesite and interbedded sandstone is exposed for 30 ft along strike. The vein trends N. 45° W., dips 70° NE., and is 0.2 to 2 ft thick.	One inclined shaft, 20 ft deep. No production.	One select sample of quartz vein material from the stockpile contained 0.22 oz/ton gold, 0.3 oz/ton silver, 0.18% lead, 0.008% copper, and 0.002% zinc.
45	Black Warrior	Several shear zones occur along and near the contact between granitic rock and dolomitic marble. The longest exposed structure was traced 480 ft along a N. 75° E. strike. Dips range from 17° to 60° SE. Vein quartz along the structure averages about 1.1 ft thick and is exposed intermittently for 325 ft. It contains pyrite, limonite, and galena. Other veins are less than 0.1 ft thick and also contain galena.	Four adits, three are 80, 55, and 30 ft long, the fourth is locked; a 12-ft shaft; one open cut and 10 prospect pits. Production is unknown.	Eleven samples: six chip samples from the longest exposed vein averaged 3.0 oz/ton silver, 0.67% lead, and 1.72% zinc. Four other chip samples are from vein segments less than 50 ft long. Three contained 9.3, 1.2, and 0.003 oz/ton silver; four contained 6.5%, 6.4%, 0.077%, and 0.036% lead; four contained 16.8%, 13.9%, 0.11%, and 0.025% zinc. X-ray diffraction analysis shows a talc-like lens to consist mainly of chlorite. Further exploration is warranted.

Map no.	Name	Summary	Workings and production	Sample and resource data
46	Delthe Black Warrior	Silver, lead, and zinc sulfide minerals occur along a northwest-trending shear that dips 50° to 70° NE. in dolomite. The sulfide minerals are generally disseminated along the shear, but material on the dump suggests that pods of nearly 100% sphalerite and galena were mined. The mineralized zone was traced for about 120 ft along strike and averages 1.5 ft thick where sampled. A small talc deposit occurs at the intersection of a mafic dike and two shears.	One working includes a 300-ft crosscut, a 50-ft drift, and a 120-ft inclined shaft. A 100-ft adit, a 25-ft trench, and six prospect pits are also on the property. Production is unknown.	Seven chip samples from the shear zone averaged about 1.5 oz/ton silver, 9.0% lead, and 9.0% zinc. Further exploration is warranted.
47	Long John	The area is underlain by dolomite, limestone, quartzite, and argillite of the Hidden Valley Dolomite. Beds strike northwest and dip steeply to the southwest and northeast. A younger felsite porphyry dike trends east across the area. Galena, lead and iron carbonate, calcite, limonite, clay, and quartz occur in a pipe-like deposit in a fissure vein in dolomite. The vein strikes N. 30° W., dips 60° E. The deposit is generally 4 to 6 ft thick and extends from the surface to a depth of 230 ft.	The main adit has about 456 ft of crosscuts and drifts with winze, raise, and stope development on the fissure vein to a depth of 230 ft. One 20-ft adit, four inaccessible shafts, and several prospect pits were developed where iron oxide, iron carbonate, and quartz are exposed at the surface. In 1925 to 1926, \$60,000 worth of silver-lead ore was shipped; in 1939, 23 tons of ore yielded 203 oz silver, 2,733 lb lead, 333 lb copper, and some gold.	Seven chip samples from the fissure vein averaged 2.14 oz/ton silver, 1.27% lead, 0.50% copper, 0.139% zinc, and 0.048 oz/ton gold. Three of these samples averaged 0.215% tin. The remaining 17 samples from dumps, structures, and altered zones contained no significant values. The pipe-like deposit appears mined out.
48	Unnamed	Limonitic gossan, 120 ft long and 1 to 2 ft thick is in Hidden Valley Dolomite.	Three cuts.	One chip sample of the gossan had no significant metal content.
49	Unnamed	A 1-ft-thick gossan zone is exposed at the cut. A zone of silicified dolomite with scattered secondary copper minerals is exposed at the shaft.	One 17-ft shaft and one cut about 200 ft apart. Probably no production.	A chip sample from the gossan contained 0.2 oz/ton silver, 0.03% copper, 0.09% lead, and 0.11% zinc. A select sample of silicified dolomite from the dump at the shaft contained 14.1 oz/ton silver, 1.6% copper, 5.7% lead, and 0.18% zinc.
50	Unnamed	Milky quartz vein and limonitic gouge zone, 1 ft thick, trends northwest for 10 ft in Hidden Valley Dolomite.	One cut.	One chip sample from the quartz vein had no significant metal content.

APPENDIX.--Mines and prospects in and adjacent to the Southern Inyo study area--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
51	Unnamed	A gossan in Hidden Valley Dolomite is 8 ft thick, 20 ft long, and trends N. 15° E. About 100 ft north-northwest is a body of high-grade talc which may be as large as 200 ft by 50 ft.	The gossan is explored by a 15-ft shaft; the talc by a prospect pit.	A grab sample from the gossan had no significant metal content. A sample from the talc body at the pit was virtually pure talc with traces of chlorite. The sample contained 31.8% MgO and 60.6% SiO ₂ . The distribution of the high-grade talc was not determined.
52	Unnamed	Highly fractured, silicified Hidden Valley Dolomite has limonitic coatings on fractures.	One prospect pit. No production	One sample of silicified dolomite had no significant metal content.
53	Unnamed	Highly sheared and pulverized Hidden Valley Dolomite with yellow-orange powdery limonite was prospected.	One prospect pit. No production.	One chip sample of sheared dolomite contained 0.05 oz/ton silver, 0.03% lead, and 0.2% zinc.
54	Unnamed	Impure, siliceous talc vein, 2.5 ft thick, and 10 ft long is exposed in the southeastern cut; silicified dolomite in the other.	Two cuts about 100 ft apart. No production.	One sample of the vein was mostly talc with minor free silica and contained 29.0% MgO and 56.6% SiO ₂ . A sample of the silicified dolomite from the northwestern pit had minor talc and contained 10.3% MgO and 79.4% SiO ₂ .
55	Long Trail	A zone of talc mineralization follows a north-trending fault in Hidden Valley Dolomite for 600 ft. Discontinuous pods and lenses of talc are about 0.3 to 5 ft thick. The largest body, at the north end of the zone, is 50 ft long, 3 to 5 ft thick, and is at least 20 ft deep.	The main talc body is developed by two groups of workings, about 500 ft apart. The southern group includes two crosscut adits, 30 and 40 ft long, one cut, and one 20-ft-deep pit. The northern workings consist of a 35-ft shaft and a 45- by 10-ft cut. About 1,000 tons was transported from the mine site via an aerial tram, probably during World War II.	Three chip samples from the main zone contained mostly talc with some chlorite. MgO ranged from 28.4% to 30.8% and SiO ₂ from 57.2% to 62.8%. The largest talc body contains about 400 tons, which is too small to be minable.
56	Unnamed	A zone of white, chalky, gritty, altered dolomite, about 10 by 20 ft, was prospected.	One 12-ft adit and one prospect pit. No production.	One sample from the zone consisted mostly of albite and clay with no talc.
57	Unnamed	A 1-ft-thick vein of cellular limonite and goethite trends northwest for 50 ft along a fault in Hidden Valley Dolomite. Some secondary copper minerals occur in the footwall of the vein.	Two prospect pits, one cut, and one 5-ft crosscut adit. Probably no production.	A chip sample of the vein contained 0.49 oz/ton silver, 0.19% copper, 1.7% lead, and 10.6% zinc. A grab sample from a stockpile contained 4.35 oz/ton silver, 0.09% copper, 7.7% lead, and 1.0% zinc. Additional prospecting is warranted.

Map no.	Name	Summary	Workings and production	Sample and resource data
58	Copper Summit	A gossan of massive goethite trends north for 480 ft in Hidden Valley Dolomite and dips 50° to 85° east. It is as thick as 5 ft. The central part of the zone contains secondary copper minerals including native copper. These minerals were not seen at the north and south ends.	Seven prospect pits and cuts, two shallow shafts. No production is evident.	Four chip samples from the gossan and five grab samples from stockpiles and dumps were collected. Samples contained as much as 14.9% copper; other metals were negligible. Two samples contained 0.22% and 0.33% arsenic, and one contained 0.11% vanadium.
59	Unnamed	A set of parallel quartz-calcite veins trend northwest along the fault contact between the Keeler Canyon and the Lone Pine Formations. The veins are steeply dipping and associated in places with an altered dike. The veins are generally thin and discontinuous, but the principal vein is as thick as 3.3 ft and crops out intermittently for about 1,500 ft along strike.	Three prospect pits are along the principal vein.	Four chip samples from the veins contained no significant metal values.
60	Silver Reef	Two mineralized zones in the Keeler Canyon Formation were identified. An easterly trending fracture zone is as thick as 3 ft and dips steeply. It is exposed intermittently in workings for about 120 ft along strike. Small amounts of lead and copper minerals occurring on a dump suggest that minerals were encountered at depth. The second zone is along a shear that strikes N. 25° W. and dips 85° NE. Secondary lead and copper minerals occur in a 0.4-ft-thick stringer and on a dump near the shaft.	Two shafts, 36 and 15 ft No. 5 deep; a 46-ft adit; and two prospect pits.	Five samples: one select sample of secondary lead minerals contained 12.8 oz/ton silver and 5.3% lead. The other samples from the mineralized zones contained only minor amounts of silver, copper, lead, and zinc.
61	Pennsylvania	Two shear zones in Keeler Canyon Formation contained lead and zinc carbonates, galena, calcite, and limonite. The northern shear zone is 300 ft long and averages 1.7 ft thick; the southern zone is 1,000 ft long and averages 2.5 ft thick.	Sixteen shafts, 1 partly caved adit, 9 prospect pits, and 5 trenches in an area about 0.3 by 0.2 mi. Between 1918 and 1969, 252 tons mined yielded 5,584 oz silver, 86,473 lb lead, and some copper, zinc, and gold.	Twenty-seven samples were collected. Samples from the northern shear zone averaged 1.1 oz/ton silver, 4.2% lead, and 4.2% zinc. Samples from the southern shear zone averaged 3.5 oz/ton silver, 5.6% lead, and 4.8% zinc. A topographic lineament suggests a possible third shear zone. Exploration for resources is warranted.
62	Unnamed	Silicified, limonite-stained, volcanic rocks are on the trace of a north-trending fault between Triassic volcanic rocks and Permian Lone Pine Formation.	One prospect pit. No production.	One chip sample of altered volcanic rock had no significant metal content.

Map no.	Name	Summary	Workings and production	Sample and resource data
63	Unnamed	A brecciated, limonitic quartz vein, 0.4 ft thick, in interbedded shale and marble is exposed in the pit.	One pit. No production.	One select sample of quartz contained 0.27 oz/ton silver, 0.06% copper, 0.15% lead, and 0.22% zinc.
64	Flagstaff	A series of shear zones with quartz veins are in phyllite, argillite, siltstone, and quartzite of the Lone Pine Formation. The largest shear zone is exposed for 450 ft and averages 1 ft thick. It contains veins of quartz and jasperoid which locally contain argentiferous galena. Four other smaller structures consist chiefly of shear zones and quartz-dolomite veins which locally contain pyrite, chalcopyrite, sphalerite, and tetrahedrite(?).	Seven adits with drifts, winzes, and stopes totaling 600 ft, one 90-ft shaft, one 80-ft inclined shaft, four other shafts, and 14 prospect pits, cuts, and trenches. USBM records indicate the mine yielded 454 oz silver and 2.66 oz gold from 1889 to 1891.	Forty-three chip and one select sample were collected. The largest structure is inferred to contain about 3,700 tons averaging 3.37 oz/ton silver, 1.36% lead, and 2.01% zinc. The structure is too small and low grade to be minable. Other structures generally had low metal content with a few small pockets that contained as much as 18 oz/ton silver, 6.0% lead, and 2.1% zinc.
65	Unnamed	A series of shear zones and quartz stringers in quartzite were prospected. The largest zone is 25 ft long and 3.6 ft thick.	Two adits, 25 and 14 ft long, and one pit.	Three chip samples from the adits had no significant metal content. One select sample from the pit had 0.12 oz/ton silver and 0.15% lead.
66	Bud's Hope	Two mineralized structures occur on the property. The principal structure is a bedding plane shear zone in phyllites of the Lone Pine Formation. The shear is marked by limonitic, argillic gouge with a few quartz veins and stringers as thick as 1 ft. The entire zone is 500 ft long and averages 1.75 ft thick. East of the shear zone, the Lone Pine Formation is faulted against Triassic volcanic rocks. The fault is marked in one place by intense blue and green copper staining and some remnant chalcopyrite.	The shear zone is explored by 6 adits, 2 shafts, 7 prospect pits and 3 trenches; the fault by two adits and one trench. Underground workings exceed 850 ft in length. Production is unknown.	Twenty-nine chip samples from the bedding plane shear averaged 0.96 oz/ton silver. Other metals are negligible. The zone is too thin and the grade too low to mine. Three samples from the fault zone contained 0.57, 3.3, and 5.2 oz/ton silver; 0.47%, 2.6%, and 8.8% copper; and 0.056%, 0.24%, and 0.064% lead, respectively. Prospecting is warranted along the fault.

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